MECHANICS' MAGAZINE,

AND

REGISTER OF INVENTIONS AND IMPROVEMENTS.

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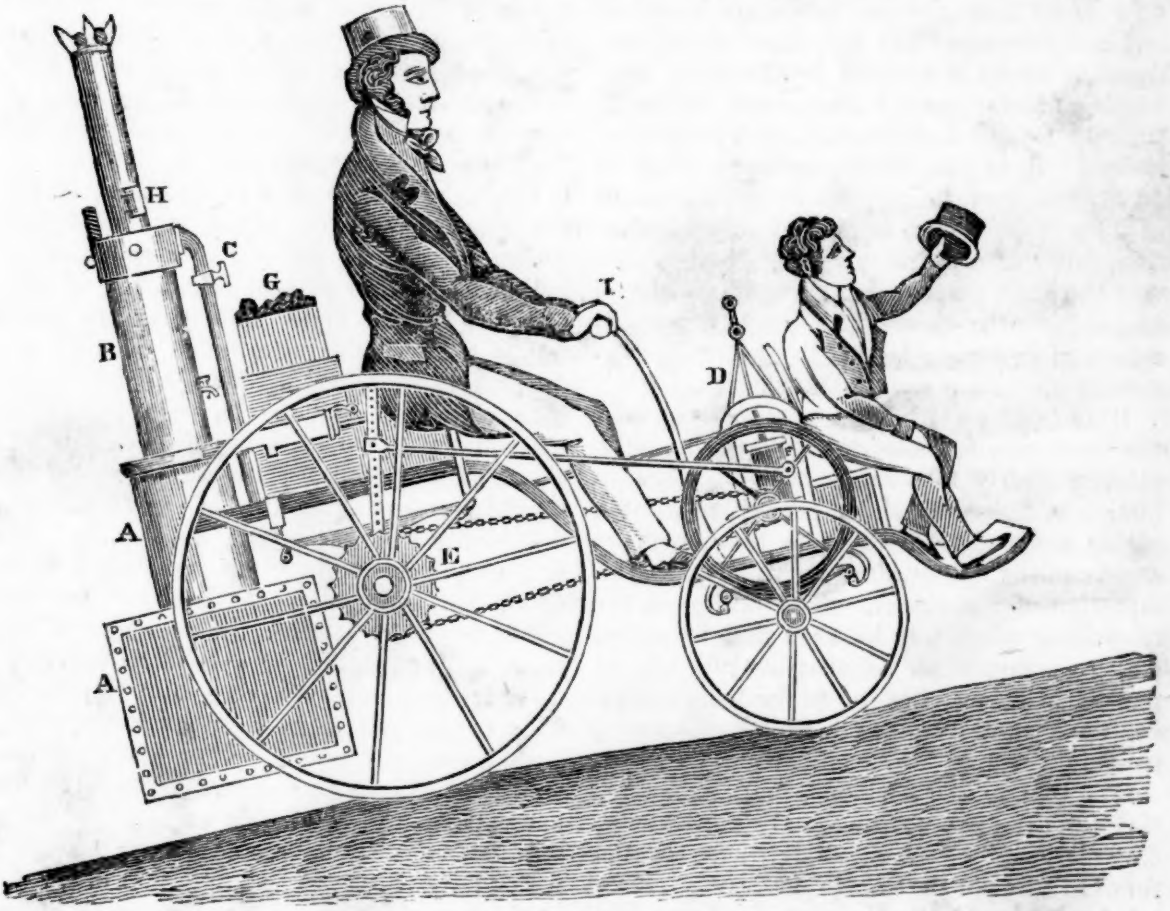
The more widely science is diffused, the better will the Author of all things be known, and the less will the people be "tossed to and fro by the sleight of men, and cunning craftiness, whereby they lie in wait to deceive."—LORD CHANCELLOR BROUGHAM.




TRAVELLING BY STEAM ON COMMON ROADS.—Although the state of the roads in this country will not at present allow us to be very sanguine of the advantages to be derived from carriages propelled by steam, we are satisfied that our readers will be gratified to possess a record of what is doing in other countries, and we hope it will rouse them to fresh exertions in promoting internal improvements here. The annexed account of the "Triumph" steam carriage, from a recent number of the London Mechanics' Magazine, will be read with interest, as also the observations it has elicited from two most valuable correspondents to that journal. One of them, Mr. J. O. N. Rutter, has been for several years looked up to as an authority on most subjects connected with engineering. He claims to be the inventor of a method of substituting water for fuel in steam engines, alluded to at page 117, Vol. II. of this Magazine, and has stated that it has succeeded equal to his most sanguine expectations at the gas works in Lymington, of which he is the superintendant.

If our information is correct, we shall

have it in our power to prove that the credit of the invention is due to an American citizen; and a patent was taken out for it in 1817, by Mr. James Morey, of New-Hampshire. Why it has not been acted upon we are at present uninformed, but we hope in our next to be able to give a full description of it, accompanied with such drawings as may be requisite.—[Ed. Mech. Mag.]

*The Triumph Steam Carriage.* By Saxula.
[From the London Mechanics' Magazine.]

Sir,—I did not intend to send you the prefixed rough drawing of my little Triumph steam carriage until I could faithfully inform you of its full powers, in regard to speed and weight propelled; but, from considerations of expense and ill health, delay succeeds to delay until I fear some claims of priority, which I pretend to, may be denied to me. It is the little carriage, (built in 1828, and first mentioned in your Journal of 29th May, 1830,) improved in construction, but the same in principle, and which was the first that ever ascended a rise of one in six; the chief alteration is the application of two main levers, to obviate the necessity of having very large wheels.

It is built on what I at present consider the best principles of my theory, namely, placing nearly the whole weight, when in motion and needful, on the propelling wheels, giving a varying leverage to the power, to any required extent, and making the line of direction of the power, when acting on the propelling wheels, to be such that its action and re-action shall as near as possible be parallel with the line of progress, by causing the fore carriage to have a tendency by its weight to propel the hinder part.

The main axle, wheels, and springs of this carriage, are so attached to the carriage frame that they can be shifted backward or forward to vary the centre of gravity of the whole at pleasure, and also keep the endless chain stretched.

A A is the tubular boiler; B, tubular chimney and steam chest; C, steam pipe, cased deep in flannel, &c.; D, a pair of cylinders, pistons, &c. working an endless chain wheel on the crank shaft and two small fly-wheels; E, another endless chain wheel, either fast or loose on the main axle; F, a pin on each fly-wheel, working alternately two main levers, that catch in two clutch wheels fixed on the main axle; G, coke box and water cistern; H, feed door in the chimney; I, pilot pole.

As soon as the engines start, the pins F on the fly-wheels begin, by means of the connecting rods, to pull at the main levers, which levers, by a re-action (if they are in gear), have a tendency to lift the fore carriage off the ground. (I have seen it thus lifted quite off.) By this operation the weight of the fore carriage is partly thrown on the hind wheels, increasing their interlocking force with the ground, and at the same time tends to pull them round by its gravity. *Note*, I do not mean to say that power is thereby gained, as all power comes from the steam, but that the power is acting in its best direction, being a transfer of the power of the steam to the gravity of the fore carriage, as the steam, with a varying leverage, cannot well act direct on the main axle. When the road is level and good, the main levers are in a few seconds put out of gear, and the unvarying endless chain, E, put in.

I would say a word or two to Mr. Alexander Gordon and the *ultra* locomotionists. Steam locomotion on common roads is no longer a question of possibility, but of economy. Messrs. Ogle and Summers could tell, if they would, how much cheaper (or dearer) they went to Liverpool by steam than if horses had taken them (including wear and tear, but rejecting accidents); and Sir C. Dance could state his profits on the Cheltenham road. Both these and other parties richly deserve public assistance. But no! somebody will have a monument when dead, but no help whilst living. Yet the public is not to blame: for to whom of the many projectors must it extend its bounty?

There was once a carriage and four horses went twenty miles an hour, at Newmarket, for a wager, and won it, yet the mails still are conveyed at half that speed. These Ultras forget that steam pistons cannot go more than 2½ miles an hour, and at that rate they will, like a horse, do a great deal of work; but if they must propel any thing at 20 miles an hour, they must either have little to propel or there must be a great many of them; and the question is, can these many be kept cheaper than horses? This waits for proof. Locomotion is a darling theme of mine, but I have paid my visit to *Utopia*, and am come back. I wish again and again some one would build an 8 or 10 horse-power steam drag, to work one of the stage waggons at about its present rate of going, and then see what power could be spared for increasing the speed. Saxula.

March 14, 1833.

*The Triumph Steam Carriage.* By J. O. N. Rutter. [From the London Mechanics' Magazine.]

Sir,—"Saxula" has named his carriage the "Triumph"; but I shall not consider the triumph complete until he has run it daily for six or twelve months on a common road, and given an accurate statement of the costs arising from wear and tear, fuel, attendance, and interest of capital. It is no proof that the anxiously desired object has been attained,—of running steam carriages on common roads,—because a carriage has been constructed that will run a certain distance at a certain rate, with a certain number of passengers or tons of merchandize. Many important undertakings have proved splendid failures, simply, as I conceive, on account of the conditions implied in their principle being imperfectly understood, or totally neglected. The necessary conditions for locomotive carriages on common roads may, I think, be clearly ascertained by a careful attention to those employed on railroads. If the published statements in reference to the engines at work on the Liverpool and Manchester railroads are to be credited, it appears that, with friction and abrasion at a minimum, those engines involve a prodigious outlay of capital in their original construction and in their subsequent repairs. Now, supposing it should be found advisable to go to a considerable expense in the construction of any future railroad, either in polishing it or in having a double line of road, each inclining throughout its whole length, but in opposite directions; and if, by these or any other arrangements, it should be found that the first expense of engines and their subsequent wear and tear would be thereby reduced, should we be any nearer than we are at present to turnpike road engines? I rather think we should be farther off than ever. On railroads, the friction, the agitation, and the consequent abrasion of surface, are found to be the chief impediments to success. How, therefore, can we expect to succeed, where we have to contend with more friction, more agitation, more abrasion, and, last, but not least, inequalities of surface, which do not exist on railroads? Far be it from me to think or say that the object is unattainable; many more unlikely things have happened, and will doubtless continue to do so almost every day. But we never can move safely towards a result until we thoroughly understand the principles of our experiment, and make ourselves conversant with its conditions. I wish "Saxula" success, and I sincerely hope he will favor your readers, from time to time, with the data he obtains in his experiments on this interesting subject. J. O. N. Rutter.

April 18, 1833.

*The "Triumph" of Saxula no Evidence of the Triumph of Steam Travelling on Common Roads.* By Dubitans. [From the London Mechanics' Magazine.]

Sir,—Some time has now elapsed since you favored me with the insertion of a few lines on long and short cranks, which I hazarded in opposition to the theory of locomotion promulgated by your ingenious correspondent "Saxula," in which I promised the result of a series of experiments I had then in contemplation, but which I have been unable to accomplish, from want of time, change of residence, &c. Trusting, however, that my not having fulfilled my engagement may not debar me from your pages, I beg, as a constant reader, to offer a few remarks which have suggested themselves since reading the account of the "Triumph Steam Carriage" in your Journal of the 6th of April last.

I am still at a loss to comprehend what advantage "Saxula" anticipates from the use of the main levers over that of an ordinary crank, save that he will by that means be able to increase his power at a very great reduction of speed, and, I conceive, a great waste of power at the same time. In the first place, does he mean to deny that a short crank would accomplish the same end, provided the power were increased in due inverse ratio, and to uphold that more can be accomplished by the use of long cranks, or *main levers*, than by short ones? If so, I need say no more, for of that I shall never be convinced. Again, if the adhesion between the periphery and the road be sufficient to enable him with his long lever to lift the fore carriage off the ground, where is there any necessity for an increased resistance or *interlocking force?* Such a tendency would only cause a loss of power and straining to the machinery, besides which there would be an irregularity in the motion of the vehicle, which would also be attended with very serious waste of power, arising from the reciprocal action of the main levers. Although "Saxula" may have accomplished the ascent of a hill, having an inclination of 1 in 6, I still maintain that the same thing might be accomplished by means

of a short crank, provided the cylindrical power of the engine were increased proportionately. "Saxula" may perhaps here ask —but why cumber your engine with more power than is actually necessary? Let him make his engine on that principle, and run it on a road—not one rolled and brushed for the purpose—and he will soon find he will be "put to a stand still." Hills are not the only obstacles which present themselves (Mr. Gurney well knows this). Newly-formed roads, or repaired ones, are much more serious objections to steam carriages on common roads. We will suppose a road (as is often the case) repaired at intervals, of say a quarter of a mile—would the "staid and sure" pair of long levers be used? or alternately levers and cranks, to the great annoyance of passengers, and prejudice of the machinery? So many delays would completely do away with steam travelling, if there were no other objections to it.

But the objections to such a mode of conveyance on common roads, compared with railroads, are so numerous, and rendered so obvious by the daily experience on the Liverpool and Manchester railway, as to need but little comment. I understand the estimated cost of an engine for common roads, capable of conveying about 20 passengers, is £1,500, while the utmost speed which could with safety, or *otherwise*, be accomplished, would be 12 to 14 miles per hour. Now, an engine capable of conveying upwards of 300 passengers in covered carriages on a railway, at 20 miles per hour, costs only £800 or £900. The wear and tear of an engine on high roads is also very considerably greater than that on a railroad, owing to irregularity of surface. I believe at 15 miles per hour it would be 7 times greater, and the force of traction 12 times as great. Supposing, therefore, that only the same consumption of fuel should take place, the diminished number of passengers would, of course, raise the fares in due proportion. But certainly the expediency of using locomotives on common roads can only be proved or disproved by actual experience. I heartily agree with "Saxula" in wishing some practical results to be given forth by the numerous and extensive speculators in such machines. I am afraid "Saxula" will find himself in error, when he states that an engine of two horses' actual power will be able to accomplish the labor of two horses on common roads. This is daily proved to be impossible: even on a railroad a portion of power is lost by the re-action, or *backsliding* (if I may so term it), produced by the deposition of extraneous matter on the surface of the rail, which causes the wheel, or rather the engine, to retrograde in a slight degree. This I have proved very frequently when travelling on the above railway. I have in fine weather invariably found that 86 beats or strokes of the engine are necessary to traverse the distance between the ¼ mile distance accurately measured, thus proving that 2 revolutions are lost in each instance, the wheel being precisely 5 feet diameter. This I have observed at speeds of from 14 to 18 miles per hour. At 25 miles per hour nearly 4½ revolutions are lost. This, I think, would militate greatly against "Saxula's" two horses.

I am, sir, yours, &c.

DUBITANS.

Liverpool, May 7, 1833.

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*On the Power of the Wind.* By G. K. O.

[For the Mechanics' Magazine.]

SIR,—The wind is a natural agent, of much power, not often at rest, and accessible to any one, but is not applied to many mechanical purposes, by reason of its extreme irregularity. It is the design of this article to suggest a method of obviating this difficulty. Let a wind-mill cause an air-tight forcing-pump to condense air in a suitable vessel: for instance, a steam boiler. If a cylindrical vessel, ten feet in length and five in diameter, be thus made to sustain a pressure of 75 pounds on the inch, it will furnish 100 cubic inches per second of air of twice its ordinary density, for one hour, and exert force sufficient to raise 1000 pounds 450 feet, and, though unsupplied by the forcing-pump, at the end of the hour sustain a pressure of 30 pounds on an inch. The air may be applied directly to a wheel, or used as steam to work an engine. The quantity emitted would of course be regulated by a governor, and a fly-wheel may be employed for further uniformity.

The same object may be attained by causing the wind, whenever it may blow, to raise water into a reservoir, whence it may be drawn at pleasure to work a wheel or hydraulic engine. One thousand cubic feet of water raised 25 feet, would, in descending, exert force sufficient to raise 1000 pounds 1,562 5-10 feet high.

Two heavy weights may also be employed: 27 cubic feet of iron, specific gravity 7 5-10, descending 25 feet, exert force suf-

ficient to raise 1000 pounds 316 4-10 feet. By means of double gearing one weight may be raised by the wind while the other is working, and when no work is doing, both may be raised. Whatever advantages may attend these means of regulating the force of wind are obvious. Yours, &c.

G. K. O.

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Sixth Annual Fair of the American Institute of New-York, Oct. 16th to 19th, 1833.—In whatever light we view this exhibition of the products of American industry, there is something auspicious of our country's greatness and happiness. As a rich and beautiful display of the advanced state of the useful arts among us, we are proud in beholding it ourselves, and not ashamed to invite the liberal stranger from distant and older climes to draw his comparisons. It not only affords an illustration of the prosperous condition of our country, but presents demonstrative arguments of the wise policy of our legislative enactments. It seems to proclaim in one great national voice, that we are a brotherhood in all our pursuits by sea and land.

One of the most pleasing features of this fair is, that it fosters a taste, which, if not characteristic of our country, harmonizes with all our institutions. Not only forty to fifty thousand of the most respectable and intelligent of both sexes throng the hall during the few days of exhibition, but it secures the presence of the able and favorite sons of the nation—calls for the talents of orators from the distant parts of the Union, and thus becomes the annual fete of the metropolis of the western world.

The eloquent and appropriate oration delivered by Mr. Kennedy, at Chatham street chapel, revised and corrected by the author, will be found at page 228 of this Magazine.

The following is as correct a list of the articles exhibited as we could obtain. We believe that very few are omitted.

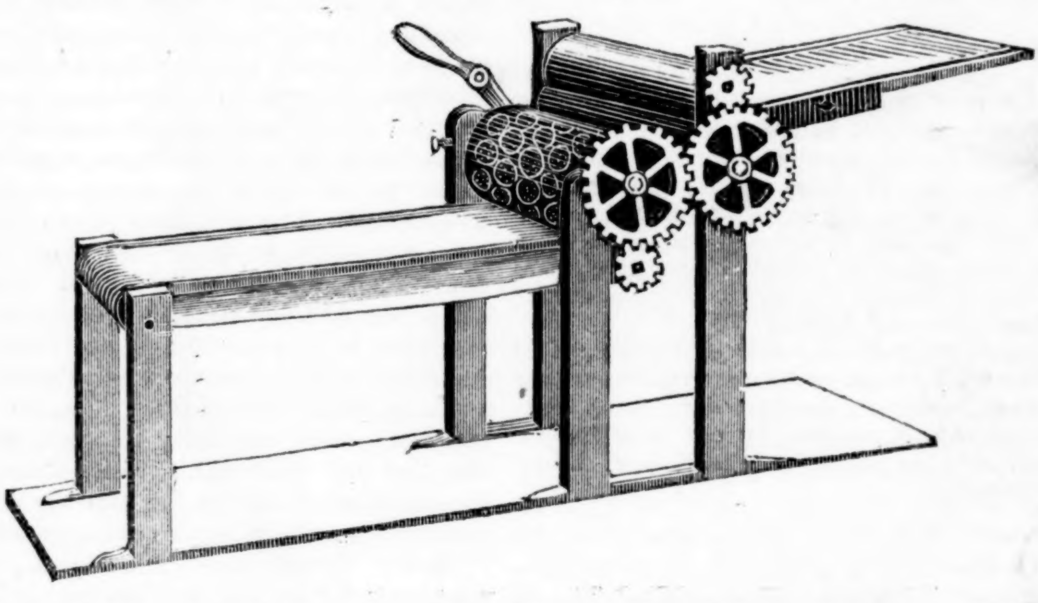
*Machinery and Models.*—Model of a steam engine, in brass, by H. Thompson, 64 Greenwich street, very neat.

A machine for softening hides, and a machine for rinsing hides; both recommended as useful inventions; by W. Brown, 28 North Moore street—premium.

Model of a new invention for steering steam boats, invented by John Harrald, watch-maker, 59 Nassau street.

S. L. Bartholomew, a very young man, 17 Lewis street, for the best specimen of a model of a steam engine, very ingenious—premium.

J. C. Bruce & Co. 27 Peck slip, for a biscuit-making machine, a most ingenious and labor-saving machine—premium.



This machine consists of, first, a cast iron frame, on which are placed, crosswise of the frame, two cylindrical rollers of metal, for the purpose of rolling or reducing the dough to the required thinness, the upper cylinder having attached to its gudgeons a screw at each end to graduate the thickness of the dough. Next, and parallel to the lower cylinder, is placed the cutting cylinder, having on its surface cutters of the required size and form, with the requisite number of teeth or prickers to perforate the biscuit and prevent their blistering. Inside of each cutter are placed the followers, somewhat resembling a wheel, between

the arms of which the teeth are set; to which followers are attached pistons that play up and down, and eject the biscuits from the face of the cutters when acted on by what we will now endeavor to describe. Inside of the cutting cylinder are placed what the inventors term an eccentric: it consists of a rod passing through the axle of the cutting cylinder, inside of which and attached to said rod are placed two pins of metal, forming an obtuse angle at each end of the cylinder; to the said angles are suspended two rollers, as long as the cylinder will admit of, the first of which rollers has grooves turned on it to admit of the free passage of the ends of the biscuit pistons, without touching, but, at the same time, acts on other pistons situated between the cutters, and which throws off the scraps or cuttings; the plain roller acting next on the biscuit pistons, discharges them by themselves, on a cloth or band, revolving round two other rollers, the first of which is placed directly under the cutting cylinder, and the band carries the biscuits off from the machine, the scraps being separated from them in the operation, as before described. The inventors have three different arrangements of the above machine in their specification, and four different methods of discharging the biscuits from their machine, the last of which they consider the simplest, though their other methods are equally effective. The dough is first placed on a receiving board, as it comes from the breaking machine, and by turning a crank it is reduced by the rollers to the thickness required, passes down between the lower roller and the cutting cylinder, by which it is pressed into the form of biscuits, delivered on and carried off by the strap ready for the oven.

The above machine has occupied the inventors upwards of seven years, to bring it to its present perfection, and is one of a series of machines, (which we shall hereafter describe,) equally simple, of their invention, calculated by the aid of an engine to perform all the labor from the flour to the oven, to which they have lately added an improved oven, that heats and bakes perpetually, and is a great saving of time, labor and expense.

The whole of the above, in connection, could be extended to manufacture from one to five hundred barrels of flour per day; and the inventors say, if adopted by our government, would save the nation some millions of money for the navy.

——— Ball, for a patent door-valve, by D. O. Macomber, agent, 52 John street—premium. This is a very simple, useful, and ingenious contrivance, effectually preventing wind from coming under or at the sides of the door, by a spring, which, pressed by means of a projection in the edges of the door, to which the hinges are attached, causes them to protrude and fill up all the crevices.

Wm. Woolley, 378 Broadway, for metallic frieze window covering—premium.

Oliver Perkins, Maine, for a press, upon the principle of the inclined plane, very powerful, acted upon by a wedge, and requiring but small power—premium.

Mr. Spence, for a self-inking machine, for letter presses, invented by him and manufactured by P. A. Sabbaton—premium.

P. Hubbard, Vermont, for a rotary hand pump, simple, powerful, and lasting, and discharges six or eight gallons a minute—premium.

A rotary pump by Elisha Hale, worthy of notice—exhibited by Mr. Walker, 455½ Broadway—premium.

W. H. Sanders, 452 Water street, for a mangling machine, a very superior article—premium.

— ———, for a mangling machine—premium.

An ingenious machine for fringing paper, by E. Fitzgerald, 43 Eldridge street.

Model of a cabinet bath, manufactured by D. Brumley, 40 Charles street—very good—suitable for the bed-chamber—premium.

John G. Rohr exhibited patent balances, which, on account of their simplicity of construction, and accuracy of principle, are superior to any thing of the kind ever offered in the United States. It consists of a combination of levers in different proportions, by which a very small weight is made to equipoise any power, so that one pound may be made to balance ten or a hundred pounds. The frame on which the machinery is placed may be either fixed in solid masonry, if intended to weigh heavy burdens, or on wheels, when to be used in stores, magazines, wharves, or public weighing places; also, on a smaller scale, to be used in stores of any description, for the purpose of weighing small weights. The principle of its construction is very accurate: any fraction of an ounce may be precisely ascertained.

C. N. Mills, 125 Maiden lane, for a variety of reeds, revolving temples, shuttles, machine and hand cards, comb plates, spindles, and other articles for weaving and manufacturing—all of good quality—premium.

Robert Orrell, Providence, R. I., for the best cane, brass, and steel reeds.

——— Collins, for a patent case-hardened axle and transom-hook—premium.

An improved fine wrought iron chest, made by J. Delano, 97 Water street, with a lock capable of being varied twelve times a day.

Mr. Thomas Miller's "Steam Bedbug Exterminator," for aught we see, will "use up" these remorseless cannibals pretty effectually. If Mr. Miller will carry this immortal utensil into Virginia, and there call it "*Chinche Destroyer*," he is a made man. We rejoice in common with the afflicted in both hemispheres upon the fair prospect of a mastery over these villainous insects. A bedbug is *hostis humani generis*, and the obligation to do execution upon him is universal. Fulton never dreamed of one-half the important benefits which his invention is likely to bring to mankind—premium.

*The Fine Arts.*—P. Kopman, of 342 Broadway, first premium for the best specimen of landscape painting in oil.

C. Bowen, 523 Pearl street, for the best water color drawing—a marine sketch—premium.

Three miniature paintings by Mr. Chambers—premium.

A view of the Capitol in straw Mosaic, by Mary MacDaniel, recommended as worthy of particular notice—premium.

A fine specimen of ornamented stained glass, by T. Thomas, 86 Wooster street—premium.

Historical painting in burnt glass, by C. J. James, 117 Grand street, both specimens worthy of distinguished encouragement—premium.

Wm. Thompson, 80 Nassau street, for the best engraving on ivory, silver, brass, and copper—premium.

A well executed portrait of Dr. Mitchell, a good likeness, by Frothingham, of Boston.

Splendid specimens of porcelain vases, tea sets, fruit baskets, &c. painted, enamelled, gilt, of tasteful proportions and shapes, by Joseph Hemphill, of Philadelphia—silver medal.

A painting of Henry Clay, a good likeness.

A likeness, and a good one, of Maj. Noah, of the Evening Star, by Miss Brower, of this city—premium; also, a miniature on stone, by the same lady.

Some good portraits, by Mr. Copman, of 342 Broadway, an artist of eminence recently arrived from Europe.

A splendid engraving by Kearney, of the Last Supper—premium.

John Chorley, for a portrait of Washington in line engraving, remarkable for correctness in lining and in light and shade, and richness of drapery, for sale by Teller, Turell & Co., 114 Fulton street.

A full length engraving of Washington by Charles.

James Elkins, 171 Murray street, for a Cameo likeness of Washington, well executed.

Miss A. Voorhees, Flatbush, for vases and basket of flowers and fruit, displaying industry, taste, and ingenuity—premium.

Miss M. B. Van Tuyl, 200 Broadway, for a fancy piece in crayon, encircled with a wreath of flowers, painted and gilded on glass, a transparent blind, and a specimen of gilding on velvet—remarkable imitation for taste, ingenuity, and execution—premium.

Miss H. A. Davis, 13 William street, for specimens of braidwork on velvet, very tasty and neat, and deserving attention—premium.

Miss Georgiana L. Woodworth, a little girl, a pupil in the Mechanics' School, for a black velvet bead bag, a beautiful specimen of gold and white bead work—premium.

*Mathematical and Philosophical Instruments.*—Henry C. Keach, 60 William street, for the best mountain barometer and thermometer—premium.

John Roach, 116 White street, for the second best thermometer—premium.

Kutz & Adams, for the best brass and ivory rules—premium.

Richard U. Masters, 107 Pearl street, for the best chronometer—premium.

*Chemicals.*—Dr. Lewis Feuchtwanger, for his chemical, medicine and fumigating preparations—first premium, silver medal. There is no branch of American industry worthy more of a particular notice and reflection for the mechanic than the chemical department, which is the guide in almost all transactions and manufactures. We were pleased with the splendid and extensive exhibition of the chemical productions of Dr. Lewis Feuchtwanger, who appears not to have spared either time, trouble, or expense, for showing the citizens what he is able to do, and what we may hereafter expect from all our rational apothecaries. His large bottle with prussic acid, which he warrants to keep without deterioration for three years, has a very frightening appearance, remembering the spectator by the skull and marrow bones at the death or the "memento mori." Speaking of the acids, we see noticed on the catalogue of Dr. F. the Formic acid, or acid prepared from the ants, promising to be of important use in refining silver; and it is said that if alloys of silver dissolved in any acid is afterwards boiled with this acid, the precious metal is precipitated by it, which, if corroborated by successful ex-

periments, is undoubtedly worth all thanks. Another article of great importance for the dyers is the celebrated Nordhausen oil of vitriol, which is nearly free of all water, and saves, therefore, a great time in dissolving indigo, which may be dissolved in this fuming acid in about half an hour, whereas the common oil of vitriol will require 4 to 6 hours to dissolve it.

*Surgical Instruments.*—Dr. Hull, Fulton street, for the best trusses—first premium.

A fine specimen of a portable bathing tub of India rubber, by Dr. W. C. Palmer, 129 Allen street, by A. Cushman, Broadway—premium.

S. S. Cozzens, 191 Church street, a specimen of leeches, bred in this city, from foreign ones, for the first time, an important article, deserving encouragement—premium.

A new invented compound turnkey, for extracting teeth, by Dr. B. F. Latterman, 137 Grand street—premium.

*Dentistry.*—Dr. Ambler, 10 Barclay st., for the best artificial teeth—silver medal.

Mineral teeth, by S. W. Stockton, of Philadelphia, of excellent quality and beautiful enamel—premium.

Dr. Francis, No 7 Chambers street, exhibited some excellent specimens, among them an artificial palate, well constructed; as also did Dr. Ambler, 10 Barclay street, and Dr. Stockton, of Philadelphia.

*Cabinet-Making.*—Edward Horton, 2 Ann street, for a pier table inlaid with brass, Egyptian marble top—premium.

Alexander Robb, 16 years of age, an apprentice to John Castle, 161 Washington st., for a rosewood portable writing desk, including a gentleman's dressing-case, a most elegant article, of superior workmanship—silver medal.

Dressing cases, beautifully inlaid, with silver furniture, by Douglass James.

The same by John Castle, and by James L. Tower, all of New-York.

A centre table, in imitation of various kinds of marble, exquisite. It is by S. Spencer, 110 Orange street.

John C. Jacobi, 53 Mott street, for a French secretary, and a pair of Gothic pier tables, the best specimen of the style of work—premium.

E. S. Woolley, 378 Broadway, for a superior sofa bedstead, on W. Woolley's patent—premium.

E. Bridgland, 451 Broadway, for a small centre table, inlaid with a variety of specimens of elegant wood—premium.

Daniel Smith, 11 Bowery, for the best gilt chair—premium.

A beautiful curled maple chair made by T. Manahan, 70 Broad street, an apprentice, is highly meritorious. We had great difficulty in finding his address; and, by the way, it is a fault in the exhibition of a great many of the articles, that there is either no label, or very imperfect ones. This ought to be remedied.

An exhibition of blinds of every possible description, by Mr. Wm. Cook, 219 Hudson street. Certainly deserving of attention—premium.

Cox & Lockwood, Poughkeepsie, for mahogany veneer blinds—premium.

*Carving and Gilding.*—L. Granbruni, 53 Vesey street, for the best specimen of wood carving—premium.

John B. Terrey, 50 Chatham street, for the best gilt picture frame—premium.

J. Tice, 80 William street, for the second best picture frame—premium.

Thomas Halliday, 479 Broome street, for a fine specimen of mould carving—premium.

*Piano Fortes, and other Musical Instruments.*—John Osborn, 184 Chambers street, first premium for the best grand action and best English action piano fortes, both for the tone and workmanship, which was adjudged to be the best cabinet work exhibited—a silver medal.

Several elegant and fine toned pianos, from the manufactory of Kearson & Son, 259 Broadway.

Bridgland & Jardine, 451 Broadway, for the second best grand action piano forte—premium.

Richard Willis, 398 Pearl street, 15 years old, for an octave flute with keys, well finished—premium.

German flutes, with many additional keys, by Perth, Hall & Pond, Peloubet, N. Y.

The same, by Asa Hopkins, Litchfield, Connecticut.

The same, by E. J. Seabrand, Baltimore, and C. G. Cushman, N. Y.

Firth & Hall, Franklin square, first premium for the best flute.

A new invented musical instrument, by E. Zwahler, 15 Rose street, which he calls a Seraphina.

C. G. Christman, 378 Pearl street, for a Seraphina and flutes—premium.

*Boats.*—E. Babtist, 606 Water street, for the best model, architecture and material boat—first premium.

W. & J. Crolius, 400 Water street, for the best boat—second premium.

*Glass and Earthenware.*—Joseph Baggot, 78 Maiden lane, for the best cut glass, both in the cutting and color of the glass—premium.

The Jersey City Glass Co., for cut glass; some of the large specimens, being difficult of execution, do great credit to the manufacturer, and also for very good plain glass—premium.

The Boston Crown Glass Co., for well-made articles of excellent quality, by Charles Goff, 164 Maiden lane—premium.

J. L. Gilleland & Co., Brooklyn, L. I., for the best plain glass—a premium.

Day, Venables & Taylor, Norwalk, Ct. for good articles of flint stone ware—premium.

*Buttons.*—Robinson, Jones & Co., Attleborough, Mass., for the best specimen of military, naval, and sporting buttons, and for the truth and finish of plain flat buttons, for sale at their store, No. 11 Cedar street—silver medal.

J. M. L. & W. H. Scovill, Waterbury, Conn., for the best silver plated metal—silver medal.

*Silk Culture.*—Mr. John H. Mabbett, 177 Grand street, for the best specimen of raw and sewing silk—premium.

Miss A. M. Parmentier, Brooklyn, L. I., for the best specimen of cocoons—premium.

Noah Wetmore, manager of the New-York Hospital, for a good pair of silk stockings, from the silk produced at that institution—premium.

Specimens of silk manufactured at Hartford, Conn. by Mrs. Moore, considered to be fully equal to the Italian.

Eliza Ainsley, 14 years of age, Williamsburg, L. I., for the best silk embroidered black lace veil, a splendid article.

J. Denmead, 134 Monroe street, for wove silk frogs, braids, &c.

Mrs. Dunn, 71 Canal street, for the best silk frogs, girdles, buttons, and cap tassels.

Mary Otis and L. J. Robins, 82 Essex st., for the best silk and satin stocks, by N. T. Otis, 8 Courtlandt street.

Edmund R. Wiley, 196 Chatham st., for fine specimens of black satin and military buff vests.

*Cotton and Silk Goods.*—The York Manufacturing Co., Saco, Maine, first premium for bleached and brown Canton flannels—a silver medal.

Wm. Almond, Philadelphia, for white and colored Canton flannels, Torrey, Goodwin & Mesier, agents—premium.

Johnson & Green, 136 Water street, for hair and silk seating—premium.

Smith, Wheeler & Fairbanks, 56 Pine st. for fine madder prints—premium.

Some beautiful embroidered silk bench covers, by Miss Julia Marcett, 182 Church street.

Stocks made by Mrs. Moody, 71 Reed street, very handsome; two on white satin, presented to Mr. Clay.

Clarissa Hart, Westchester co., a piece of linen shirting and diaper—silver medal.

*Wool.*—George Coggill & Son, 275 and 290 Pearl street, for a specimen of very fine American Saxony fleece wool, from the state of Ohio, very fine, and rarely surpassed by the best samples of foreign wool—premium.

*Woollen Goods.*—The Glenham Co., Fishkill, A. L. Ulrick, superintendant, for the best blue and black broad cloths, Peter H. Schenck & Co., 34 Pine street, agents—silver medal.

The Great Falls Manufacturing Co.. Sommers, N. H., for the second best blue and black broad cloths, John Spring & Co., agents, 52 Pine street—premium. All these cloths exhibit much skill in the manufacture and finish.

The Buffalo Woollen Co., for a fine specimen of blankets, S. Grosvenor & Co., 6 Cedar street—premium.

The Middlesex Manufacturing Co., Lowell, Mass. for the best piece of cassimere, a drab and printed cassimere, Steele, Wolcott & Richards, agents, 62 Pine street—silver medal.

J. Buckley & Co., Poughkeepsie, for two pieces brown crape camblets and one mixed Napoleon cord, J. & W. Lockwood, agents, 19 Cedar street—silver medal.

Black cloth from the Salmon Fall Manufactory, taken promiscuously from a case, and sent by Torrey, Goodwin & Mesier, the price $7 per yard.

Wm. H. & W. R. Jones, Cold Spring, L. I., sent by B. A. & A. Mott, 67 Pine st., 2 pieces very fine white flannels, superior quality, made from wool grown by themselves, and manufactured at their factory—silver medal.

Mrs. Betsey R. Voorhees, Amsterdam, Montgomery co., for a fine merino shawl, and fine woollen, linen, and cotton stockings, dyed, spun, and manufactured entirely in her family—silver medal.

Horn & Schieffelin, 53 Maiden lane, for very superior specimens of knitting—premium.

S. P. Durando, 5 Vandewater street, for good specimens of boys' clothing.

George Spring, 55 Pine street, for articles of India rubber clothing—very useful—premium.

*Ladies' Straw Hats.*—Miss Daniels, 116 William street, for a split straw cottage bonnet—first premium.

A. & S. White, 435½ Pearl st., second best split straw bonnet—premium.

E. & S. Merrill, 332 Broadway, for ladies' silk hats, a complete specimen of taste and workmanship—premium.

Miss E. Thomas, Norwich, Connecticut, for a grass bonnet.

*Hats.*—B. J. & J. W. Hunt, 94 Delancy street, for the best beaver hat—silver medal.

Orlando Fish, 198 Chatham street, second best do.—premium.

A fine specimen of beaver napped hats, on wool bodies, well worthy of notice, by Orlando Fish—premium.

Plaited hats, well worthy of notice, Joseph Juel, 221 Broadway—premium.

West & Scholey, 196 Hudson street, for superior black satin beaver hats—premium.

Onwin & Simms, 5 Chatham square, for superior drab satin beaver hats—premium.

John Broidley, 14 Thompson street, for a whalebone plaited hat, curious, and may be useful.

Firemen's caps, by R. D. Roberts, 1 Division street; do. by D. A. Baker, Swamp place, both fine specimens.

*Furriery.*—F. R. Boughton & Co. Utica, for the best and second best fur seal skin caps, presented by Swift and Nichols, 158 Water street, New-York—first premium.

Fry & Rousseau, Troy, for the best fur otter skin and cap, for sale by Wm. Augustus White, 172 Water street, New-York—first premium.

Timothy Hall, Troy, for the second best do. for sale by Van Tine & Co. 128 Water street—second premium.

Dressed otter skin, by E. Raymond & Co. 185 Water street.

And A. M. & E. T. Ryder's, 236 Water street, are fine specimens.

*Hemp.*—Abraham Varick, Utica, for a specimen of hemp grown in Lewis county, presented by Peter Remsen & Co. Pearl st., as a sample from 100 to 200 tons of the parcel—premium.

A beautiful specimen of Sisal hemp, from H. Perrine, of Campeachy—S. Fleet, 87 Washington street.

*Leather.*—D. B. Winton, Herkimer county, for a specimen of excellent leather, by Corse & Thorne, 14 Jacob street—premium.

*Boots and Shoes.*—Thomas Lane & Son, No. 1 Murray street, for the best ladies' boots and shoes—first premium.

C. Covenhoven, 357½ Broadway, for the 2d best do.—second premium.

S. C. Smith, 68 Chatham street, for the best India rubber shoes and boots—first premium.

Robert Webber, 130 Canal street, for the best gentlemen's water-proof boots and dress cloth—first premium.

Ladies' sandal boots, and a shell heel, from J. M. Levick, 71 Canal street, recommended highly, but too late for competition—premium.

*Carpets and Oil Cloths.*—Andrews, Thompson & Co., 180 Broadway, for the best three ply carpeting—first premium.

Mr. D. McCauley, of Philadelphia, exhibited specimens of floor cloth and carpeting. Of the latter, some of a piece made for the House of Representatives—silver medal.

D. Powers & Co., Lansingburgh, for the best floor oil cloth—silver medal.

J. Humphrey, West Farms, N. Y., for the best Brussels carpeting—second premium.

Miss Charlotte Van Wyck, Poughkeepsie, for the best hearth rug—premium.

*Hardware.*—Miller & Smith, 95 Maiden lane, for edge tools of superior quality, A No. 1—a silver medal.

Parr & Fowler, 24 Canal street, for a first rate impenetrable lock—silver medal.

Thos. H. Potter, Phillipsburgh, Penn. for the best large wood screws, Samuel Corp, 45 Pine street—silver medal.

Williamson's screw augers, a very ingenious improvement—premium.

Tin roofing, by John Woolley, appears to be an improvement upon an old plan—premium.

R. Heinich, Elizabethtown, N. J. for tailors' shears of superior quality and shape—premium.

A quantity of cast steel plate augers of good workmanship, said by judges to be a great improvement; to be had of J. H. Taylor, 4 Fletcher street.

Door plates, well executed, by T. R. Whitney, 11 Madison street.

Cutlery, very good, quite equal to that imported from Sheffield and Birmingham, exhibited by Miller & Smith, 95 Maiden lane.

Oliver Ames, Easton, Mass. for the best spades and shovels, sold by Sampson & Tisdale, 218 Water street—silver medal.

Daniel Adams, Springfield, Mass. for the best sand-paper, A. & S. Willetts, 303 Pearl street—premium.

O. Dickinson & Co. for the best twisted gimblets ever seen (by the judges), Hubbard & Casey, 48 Exchange Place—silver medal.

T. & B. Rowland, Philadelphia, for the best mill and cross-cut saws, Edward Field, 219 Pearl street—premium.

Jesse Delano & Co. 97 Water street, for a superior iron chest—premium.

A. Harrison, for axes, first rate finish, Sampson & Tisdale, 218 Water street—silver medal.

Second best shovels, Dan. E. Delavan, 389 Broadway—premium.

Pitchforks, J. H. Rogers, Colebrook, Ct. none better—premium.

Second best knob locks, Thos. Pye, 143 Leonard street—premium.

Best silversmith's anvils, Wilcox & Roys, Sawpitts, New-York—premium.

Italian iron, a good article, Sam. Harrison—premium.

Brass fire sets, Smith's, fine specimens, D. E. Delavan & Co. 489 Broadway—premium.

Japanned tea trays, fine specimens, J. Smith, 217 Water street—premium.

Brass and copper wire, well manufactured, Holmes, Hotchkiss, Brown & Elton, J. L. James & Caswell, 287 Pearl street—premium.

Cast iron, *malleable*, various articles, such as coach steps, two bars welded the same as wrought iron, coach hinges, finished in handsome style, coin, carriage and harness mountings. These articles have all specimens of their kind hammered, bent and welded, showing them to be equally strong as wrought iron, and capable of being applied to any use: from Messrs. Crocket, Boyden & Co. of Newark, N. J.—silver medal.

Hotchkiss, Brown & Elton, for sheet brass, worthy of notice—premium.

Benedict & Coe, Waterbury, Conn., for sheet brass, worthy of notice, by F. G. Turner, 231 Water street—premium.

*Books and Stationary.*—David Felt, 245 Pearl street, for the best account books, ink, inkpowder, and sealing wax—premium.

Allen & Co. Boston, and Wm. Minns, 116 Water street, New-York, for the second best account books—premium.

A large Bible of extra and fancy binding, by S. T. Wilson, 200 Broadway, recommended as worthy of particular notice—premium.

C. P. Dakin, 5 Maiden lane, for the best manifold writer—premium.

Mr. Vale exhibited a globe cosmorama horizon, showing what stars are above the horizon in any part of the earth—an exceedingly simple and useful apparatus for the student—premium.

New concentric brazen meridian globes, made by Josiah Lowry, of Boston; also, ivory and slate globes, from the same manufacturer, for teaching geography and astronomy.

J. H. Colton & Co., 9 Wall street, for a map of the State of New-York, well executed.

Le Count & Hammoud, 4 Wall street, for a map of the city of New-York, an excellent article—a premium.

Rev. R. C. Shimeal, for an ecclesiastical chart, highly recommended, and presented by J. H. Colton & Co., 9 Wall street.

W. Norris, 66 Fulton street, for a specimen plan of an estate.

S. Stiles & Co. for a map of Norwich—a good specimen.

Dr. Beam, 364 Fifth street, for the best red ink.

For the best goose quills, wafers and pens, to Patrick Byrne, 60 William street.

Messrs. C. Wright & Co. 45 Maiden lane, exhibited some beautiful specimens of ornamental borders for cards and other purposes. They are executed in a superior manner by engine turning, in brass, and printed in a variety of colors. It is an art that has received very great patronage in England, but only just now introduced into this country.

Mr. Cohen, of William street, also exhibited some, but we think much inferior to Wright & Co.

*Perfumery.*—Snyder & Co. Cedar st., first premium for the best Cologne water, perfumery, soaps, and white wash balls, a large and handsome display—silver medal.

*Penmanship.*—F. W. Williams, of 339 Bleecker street, specimens the best exhibited—premium.

J. Goward, 371½ Grand street, the second best—premium.

*Sign Paintings.*—T. P. Hyatt, 75 Grand street, for the best Roman and black lettering—premium.

Thos. T. Hogg, 21 Wall street, for the best ornamental sign painting—premium.

Geo. Fordham, 136 Water street, for the second best sign large and small letters—premium.

*Brushes.*—Wm. Steele, 289 Pearl st. fancy brushes, very elegantly painted and ornamented—premium.

The brush and bellows exhibited by Mr. Steele, 289 Pearl street, are very good. The articles are of superior fabric.

*Silver Ware.*—Baldwin Gardner, corner of Liberty street and Broadway, for the best silver waiters and pitchers, a most splendid article—silver medal.

Gold and silver spectacles, by Jared I. Moore, 142 Chatham street, all worthy of particular notice.

*Corsets.*—Mrs. Willington, 94 Duane st., for the best corset—premium.

Premiums were also awarded for the following:

For enamelled hollow ware, upon the plan of German ware, manufactured by Brette, Webster & Co., Albany, a perfect article, and as high or higher than the German article—a most valuable manufacture—silver medal.

For tinning hollow ware, cast by Crocker & Richmond, of Taunton, tinned by Mr. Nabbet, same place—Tisdale & Richmond, 210 Water street, agents—first ever manufactured in the United States—a very valuable article—silver medal.

James Spencer, 110 Orange street, for the best painting in imitation of wood—silver medal.

Imitations of marble, painted by E. Ramsbottom, 44 Canal street, far more perfect fac similes than any thing of the kind we ever saw—silver medal.

The substitute for an amputated knee, by James Kent, convinced us that this business of losing a leg is not so serious a business after all. Mr. Kent's *succedaneum* will, to say the least of it, answer an excellent purpose for those "who go down upon their knees to the fair"—silver medal.

J. Xavier Chaubert, for a model of a new and extraordinary piece of ordnance, which by means of machinery, to be worked by one man, for a 24 lb. cannon, is capable of loading and discharging thirty charges in six minutes—together with an original invention of a ball adapted to any bore, which will divide into four parts on being discharged. American invention, and may become very important—a silver medal.

M. Furst, for specimens of very superior die-sinking.—silver medal.

Isaac Pugh, Philadelphia, for beautiful paper hangings—silver medal.

A fine specimen of marble and fancy colored paper hangings exhibited by Phyfe, agent, Maiden lane.

S. W. Benedict, 30 Wall street, for diamond necklace and gold watch dials, made of American gold.

A perpetual calendar, with names of distinguished Americans, by Theodore Guiland, 140 Fulton street, is considered an invention, and deserves commendation.

An eight-day clock, from Whitney & Hoyt, 380 Pearl street.

C. Cornelius & Son, 156 Fulton street, best specimen astral lamps.

S. Megrath, 245 Grand street, for second best astral lamps.

Japanned tea trays, by J. Smith, 217 Water street.

Charles De Forest's (of the Phœnix Foundry) specimen of loaf sugar we believe cannot be surpassed in any part of the world. It is withal *cheap*, a consideration not to be overlooked by the consumer. We understand that it is made by an entire new process.

Mrs. Sayres, of 22 Harrison street, exhibited a large ornamental cake. It weighed 40 lbs., and was decorated with architectural designs.

Mr. James Thompson, 171 and 176 Broadway, exhibited a most beautiful and tempting collection of ornaments in sugar and confectionary, which we know by previous experience to be of a superior quality, and not to be surpassed in beauty.

E. C. & R. E. Moss, 492 Grand st., for purified cotton seed oil.

J. J. Girard, 388 Broadway, for do., both equally good.

Mrs. James Russell, 526 Broadway, for the best scrap table and shell work-box.

Sperm candles exhibited by Samuel Judd, Water street, are deserving of notice; they are said to burn without running, and do not require *snuffing*.

E. & S. Rockwell, 192 Broadway, for a cast iron and glass vault light.

M. Kirk, 330 Broadway, for an eight-day clock and repeater.

Thomas Goodwin, 75 South street, for a fine specimen of gilding on glass.

An uncommonly curious and elegant specimen of shell work, by Mary Smith, 116 Washington street.

Miss A. Corwin, 45 Hicks street, Brooklyn, for a beautiful water color flower painting.

Miss Gifford, New-York, for a bead scarf and bracelet, the prettiest article of the kind.

Miss M. Smith, at the Mechanics' School, 116 Washington street, for a shell temple, an excellent specimen.

Julia Marcett, 189 Church street, for the best embroidery frame work in two parlor benches.

Miss Edsell, 31 Harrison street, for the second best ditto, in a sampler and bag.

Jane Gibson, 191 Sullivan street, for the best specimen of fancy embroidery, in a needle work landscape—much admired.

Miss Susan Sullivan, 185 Duane street, for the best chenille embroidery.

We witnessed one specimen of female ingenuity and perseverance. It is a cape made of parrot's feathers, by Mrs. Little, of 440 Washington street, after four years' labor. The *plumage* is laid on so naturally that the most fastidious parrot in such a dress would call herself "pretty Poll."

We will never hereafter hear the "wooden ware of New-England" abused. Hyman Clark & Co. of West Stockbridge, Massachusetts, show some "coolers" turned, as "an unit," from solid wood—some parti-colored pails, &c. which are really beautiful, and redeem entirely the bad character of wooden dish utensils of old Barkhemstead.

Nor ought we overlook the *Capellary* establishment of Mr. E. C. Hunt, who displays very capital wigs and curls, and who makes them at 425 Pearl street. Sebastian Jaclard, 163 Broadway, makes good wigs too, and his *toupees* and curls are altogether *magnificent.*—Let any body that has looked at them through his window in Broadway dispute us. The grace with which he mounts them upon the wax caput of his dapper little gentleman ought to give them immortality.

H. Huxley & Co., 87 Washington street, for 24 specimens of grass seeds.

Dr. Lewis Levesky, 53 Mott street, for a specimen of mustard, agreeable in flavor and of very superior quality—a superior article.

Robert Usher, a specimen of beef cured according to the Irish method, by which provisions are preserved in long voyages—a very superior article.

Chandler & Mason, 130 Maiden lane, for excellent cedar pails.

H. Gifford, Syracuse, for first rate ground salt, in loaves, for sale by A. B. Rumsey, Front street, near Fulton.

Thomas R. Whitney, 11 Madison street, for the best specimens of door plates, and for visiting cards.

J. D. Stout, 3 Wall street, for his four-sided tablets, for sharpening razors, a substitute for the hone, and for producing an edge.

Samuel L. Post, corner of Murray street and Broadway, for the best travelling trunk, hat case and gun case. The second best do. by Richard A. Chambers, 172 Broadway.

The best rocking horse, by R. H. Olson, 99 Orchard street.

Francis Baker, 538 Greenwich street, for fancy transparent blinds.

Daniel Holsman, Paterson, N. J., for a counterpane, by Torrey, Goodwin & Mesier, 48 Pine street.

Mary Williams, Staten Island, for a bed quilt.

Allen Smith, 52 Howard street, a patchwork quilt.

Mrs. Hancock, 16 Beekman street, for two bed quilts.

Mrs. Mary Collard, 3 Desbrosses street, a counterpane.

Walter Morton, 17 Cedar street, for a bed quilt, orange color.

A beautiful and ingenious little basket, made of beads and melon seeds, by a little girl.

John G. Rohr, for a pair of excellent jack-screws.

Pierson & Co., 11 Maiden lane, for a beautiful olive broadcloth ladies' coat.

Joseph M'Carthy, Jersey City, for fine specimens watch glasses.

Jordan L. Mott & Co., for a superior patent compass lamp—Wm. Lawrence's patent.

Teller, Turell & Co., 114 Fulton street, for specimens of volumes of standard British authors, (Scott, Johnson, &c.) the stereotyping done at the foundry of Connor & Cook, and A. Pell & Brother—the binding by G. H. Griffin—presented by Teller, Turell & Co.

Alfred Willard, Boston, for three dozen horn combs, well manufactured—J. Davenport, 141 Water street.

Christopher Freed Meder, 40 Canal street, for a specimen of looking glass plate, with diamond cut edges, made by him in this country.

J. W. Nicholson, 13 Rivington street, for specimen of blank checks, to prevent forgery.

Charles C. Plaisted, 66 Chambers street, for the second best ditto.

John M. Kirk, 330 Broadway, for three spring clocks.

Jordan L. Mott, 113 South street, for a self-supplying stove for coal—simple in construction, of good appearance, and burns

well—and also for a binnacle lamp, recommended by masters of vessels as being superior to any other now in use.

Mary A. McCune, aged 1 year, pupil of Public School, No. 5, a handsome worked sampler, and two covers for foot stools.

Mrs. Mary Collard, No. 4 Desbrosses st., a white counterpane—beautiful specimen of quilting.

C. C. Voorhees, 53 Forsyth street—a pair of shell vases and flowers—very fine specimens.

Miss C. L. Donaldson, 19 Great Jones st., one pair shell vases and flowers, very beautiful.

——, for a pair of worked candlesticks, by the Missionary Society of the First Presbyterian Society, Brooklyn.

——, for a valuable improvement in a pair of sad irons, the owner unknown, as no mark appears on them.

A. Warner, 31 Spring street, a coat of arms of the United States, carved and gilded.

Wm. Cullen, for a pair of beautiful brass wafer stands.

Endicott & Sweet, 111 Nassau street, for superior specimens of lithography—a silver medal.

C. C. Wright & Co., 45 Maiden lane, for a lithographic press—a new and useful invention.

Geo. Dunn, Newark, for dearborn, sulky, and stanhope frames.

Johnson & Green, 136 Nassau street, for superior hair seating.

Miss B. Thompson, 12 Laight street, for the best wax fruit.

Mrs. Watmough, 288 Bleecker street, for two very handsome lamp stands.

Miss Julia Malison, 216 Morrison street, for the best wax flowers.

Louisa Poillion, 90 Duane street, for the best pair of muffs for the feet in carriages and churches.

Uriah Watson, 152 Chatham street, for very neat first rate spectacle cases.

Robert J. Guard, for purified sperm oil.

John W. Morgan, 226 Grand street, for do.

Mr. F. Murphy's exhibition of *blacking* will, if properly appreciated, make him a *shining* character. Hunt's is nothing to it, though it got him into parliament. That Murphy's blacking, both solid and fluid, is of very extraordinary merit, we say with great confidence, for we have *pedal* experience in it. He makes it at 349 Grand street, and let it be remembered that it is *American*.

N. B.—The premiums, consisting of medals and diplomas, when ready, will be delivered at the office, No. 74 Liberty street, by Mr. Edwin Williams.

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The Philosopher Nonplused.—De la Croix relates the following almost incredible instance of sagacity in a cat, which, even under the receiver of an air pump, discovered the means of escaping a death which appeared to all present inevitable: "I once saw," said he, "a lecturer upon experimental philosophy place a cat under the glass receiver of an air pump, for the purpose of demonstrating that very certain fact, that life cannot be supported without air and respiration. The lecturer had already made several strokes with the piston, in order to exhaust the receiver of its air, when the animal, which began to feel herself very uncomfortable in the rarified atmosphere, was fortunate enough to discover the source from whence her uneasiness proceeded. She placed her paw upon the hole through which the air escaped, and thus prevented any more from passing out of the receiver. All the exertions of the philosopher were now unavailing; in vain he drew the piston; the cat's paw effectually prevented its operation. Hoping to effect his purpose he let air again into the receiver, which, as soon as the cat perceived, she withdrew her paw from the aperture, but whenever he attempted to exhaust the receiver she applied her paw as before. All the spectators clapped their hands in admiration of the wonderful sagacity of the animal, and the lecturer found himself under the necessity of liberating her, and substituting in her place another that possessed less penetration, and enabled him to exhibit the cruel experiment."

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Mr. Rutter's Grand Discovery.—"If real," says an esteemed correspondent, "it will change the face of the world. To convert water into fire has been long a favorite speculation with philosophers, though hitherto the practical means of accomplishing it have constantly eluded their research. Among others who have distinctly pre-figured the discovery, and one of the greatest advantages to be derived from it, namely, its application to steam navigation, I may mention your ingenious friend, Junius Redivivus, who, in his 'Tale of Tucuman,' has these lines:

> 'Combustion's principle resides in water,
> And if we decompose it, hydrogen,
> Thus gathered, may be used as burning matter,
> To drive our merchant prows across the main.'"

M. GUESNEY'S NEW SYSTEM OF PHILOSOPHY.—Sir John Byerley has recently introduced into England a globe of a new and important character, invented by M. Guesney, an advocate of Coutances in Normandy, and described by him in a work entitled *Mouvement Heliaque*, Paris, 1825. Many of the more important phenomena of geology and physical geography have given birth to the wildest theories. M. G. being led to regard them as produced by the precession of the equinoxes, attempted their solution on scientific bases. Unfortunately M. G. is a sworn enemy of the Newtonian system, and while his whole theory is grounded on the precession of the equinoxes, he denies the cause of that precession, and affirms that the earth is perfectly spherical! His work abounds with errors quite as easy to refute, but he has the great and exclusive merit of having first had the idea of constructing a terrestrial globe in harmony with the celestial, by tracing the system of the ecliptic upon it as upon the celestial globe.

We may here observe, that the whole of the appearances in the heavens are to be referred to the two motions of the earth. The polar star is not polar to any planet but our own; and the poles of the ecliptic in the folds of Draco and in the Dorado are only so in reference to the earth. The axes of the world, as they are called, or those of the ecliptic and the equator, are two lines crossing each other *in the centre of the earth*, at an angle of 23° 28′, and extending to the heavens; but, we repeat it, they do not pass through the centres of any other planets; and are, therefore, to be referred to the earth alone.

The points where these lines pass through the surface of the earth are the poles on which its motions are performed, the movement of rotation, or diurnal motion, on the poles of the equator, and the movement of translation, or annual motion, on the poles of the ecliptic. M. Guesney's great difficulty was to fix the seat of the poles of the ecliptic on the terrestrial globe. In this he received no aid from astronomers, who declare the ecliptic to be a circle in the heavens, and to have no reference whatever to the earth, forgetting that, as the plane of the ecliptic passes through the centre of the earth, *it must cut its surface somewhere:* to determine those points, then, and consequently the poles of the terrestrial ecliptic, was the object of M. Guesney. He found that the magnetic needle and its dip were both directed to one point on the globe near the polar circle at the back of Iceland, precisely on the first meridian adopted by order of Louis XIII., passing through the island of Ferro. He found that, by supposing the seat of the pole of the ecliptic there, it gave a satisfactory solution of many hitherto inexplicable phenomena; he therefore fixed it there by approximation. Sir J. B. appears to be the only scientific person who has taken the trouble to sift the wheat from the chaff, and on this basis to erect a theory embracing the principal phenomena. Not, however, satisfied with approximation, where mathematical accuracy was evidently attainable, he endeavored to ascertain precisely the poles of the terrestrial ecliptic, when, fortunately, he found that Laplace, pursuing another object, had already solved the problem.

To avoid the confusion of every maritime nation using a different first meridian, Laplace wished them to take that "of which the midnight corresponds with the instant when the great axis of the ecliptic is perpendicular to the right line of intersection of the equator and ecliptic, which meridian is 166° 46′ 12″ east of Paris," or 169° 6′ 27″ east of Greenwich Observatory.

On the authority, therefore, of the greatest astronomer of any age, Sir J. B. has had a terrestrial globe prepared by Mr. Newton, with the system of the ecliptic described on the poles as fixed by Laplace; the north pole of the ecliptic being in the polar circle, and the winter solstitial colure, or first meridian, 10° 53′ 35″ west of Greenwich. A circle drawn from this pole as a centre, on a radius of 23° 28′, will pass through the pole of the earth, and trace its line of motion round the pole of the ecliptic, in 25,920 years.

This revolution of the pole of the equator round that of the ecliptic is admitted by all astronomers to take place in the *heavens*, but not in the earth. They admit, too, that the axis of the ecliptic is fixed and immovable, the ecliptic being so; but they have not yet shown how a right line intersecting another fixed right line at a given angle shall move round the latter at its extremity, and not at a given distance from the point of intersection! Assuming, then, that the pole of the equator revolves round the pole of the *terrestrial ecliptic*, it remains to show a few of the terrestrial effects of such motion.

By inspection of the globe, we find that the pole of the equator is now at nearly its greatest distance from western Europe; that it is advancing at the rate of about 394 yards

annually on North America, and will pass through Lancaster Straits, Hudson Straits, over Resolution Isle, enter Europe at Cape Finisterre, pass over Bilbao and the northern frontier of Spain, through France over Toulouse, through Lombardy over Milan, through Germany over Vienna, and pass into Russia over Moscow, &c. &c. It is found that the solstitial colures are almost entirely in the ocean, cutting only a small portion of Western Africa, and a portion of Kamschatka, and proceeding without interruption until they meet the lower part of New-Zealand.

On inspecting the globe farther, we find that Kamschatka was at a given period within the tropics, which accounts for tropical fossils being found in the polar regions; and that the Oural Mountains were formerly in the latitude of Mexico, which explains why the precious metals are found in such high latitudes, and why the same precious stones are found in Mexico and the Oural Mountains. We find also that the direction of the straits in the higher latitudes run from west to east, or in the direction of the waters of the pole. The debris of mountains are found in the same direction in England, France, Italy, Scandinavia, &c. The plains of Lombardy are covered with Alpine debris, and in Scandinavia, masses of 50,000 tons have been transported, (Dr. Buckland fancies on the back of an iceberg,) by the immense force of the Polar Ocean.

The radius of the earth at the equator is about 65,000 feet greater than the polar radius, owing to the centrifugal force (which is as the radii of the parallels of latitude). And, as the pole moves through 46° 56′ of latitude in 12,960 years, in that lapse of time one part of the equator will be carried 46° 56′ into the southern hemisphere. At that period all western Europe will be buried under the waters of the pole (forming the period of a deluge), as it was at three distinct periods, at intervals of nearly 26,000 years; which ascertains the existence of the globe in its present state (which was probable its primitive) for 70,000 years. This change of the plane of the equator is probably the cause of all the great phenomena; it changes the latitude from polar to tropical regions, and thus renders a change in the action of the centrifugal force; and from whatever part the pole is receding, the centrifugal force is increasing, which produces an alteration of surface; in whatever place it is advancing there is a consequent depression. There is thus a daily tendency to elevation in some parts, and to depression in others; and to this cause Sir J. B. attributes earthquakes and volcanic action. According to this theory, as the elevation and depression must be greatest in the direction of the motion of the pole, so ought the degree of volcanic action to be. On inspecting the globe, we find this to be the case, and that volcanic action is greatest on the meridians of South America and the Philippine Isles. Where no elements of combustion exist we have eruptions of mud, &c.

The difference between the earth's radius at the equator and at 45° is 5,340 French toises, or about 33,000 English feet. Now, the equator changing its position nearly 47°, it follows that in the solstitial colure the present position of the equator will be depressed at least 33,000 feet. This will readily account for marine fossils being found in Chimborazo, 15,500 feet above the surface of the ocean.

The above is a brief outline of the system to which Sir John Byerley intends shortly to call the attention of the public. He courts inquiry; for, if the theory be well founded, it will entirely re-model the science of physical geography.—[British Cyclopædia.]

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Minerals in Vegetables.—In many parts of the East there has long been a medicine in high repute, called *Tabasheer*, obtained from a substance found in the hollow stem of the bamboo cane; some of this was brought to England about twenty years ago, and underwent a chemical investigation, and proved to be an earthy substance, principally of a flinty nature; this substance is also sometimes found in the bamboo grown in England. In the hot-house of Dr. Pitcairn, at Islington, subsequent to this time, there was found in one of the joints of a bamboo which grew there, on cutting it, a solid pebble about the size of a pea. The pebble was of an irregular rounded form, of a dark brown or black color; internally it was reddish brown, of a close dull texture, much like some martial siliceous stones. In one corner there were shining particles, which appeared to be crystals, but too minute to be distinguished even with a microscope. This substance was so hard as to cut glass. The cuticle, or exterior covering of straw, has also a portion of flinty matter in its composition, from which circumstance, when burnt, it makes an exquisitely fine powder for giving the last polish to marble, a use to

which it has been applied time immemorial, without the principle being philosophically known. In the great heat in the East Indies, it is not uncommon for large tracts of reeds to be set on fire in their motion by the wind, as I am told by Captain N——, which I conjecture must arise from the flinty surface of their leaves rubbing against each other in their agitation. These facts cannot avoid presenting to the mind, at one view, the boundless laws of nature; while a simple vegetable is secreting the most volatile and evanescent perfumes, it also secretes a substance which is an ingredient in the primeval mountains of the globe.—[From "Elements of the Science of Botany as established by Linnæus," an entertaining and instructive work. Martial, in the above extract, means containing iron, and siliceous means flinty.]

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On the Production of Manuscript Books, and the Occupation of the Monks in Former Times.—There is scarcely any error so pcpular, yet so unfounded, as that which invariably attributes unbounded indolence to the monastic orders of former days. To them we owe the preservation of literature, both in the pains they took to perpetuate history by their labors in transcribing, and by their diligence in the education of youth. In the larger monasteries a chamber was almost always set apart for writing, allowing room in the same apartment for other quiet employments also. The transcribers were superintended by the abbot, prior, sub-prior, and precentor of the convent, and were distinguished by the name of *Antiquarii*. These industrious persons were continually occupied in making new copies of old books, for the use of monasteries; and by this means many of our most valuable historical records were preserved. The learned Selden owed much of the information which he gave to the world, concerning the ancient dominion of the narrow seas, to monastic documents.

The Anglo-Saxon monks were most celebrated as writers, and were the originators of the small Roman letter used in modern times. The greatest delicacy and nicety were deemed essential in the transcribing of books, whether for the purposes of general instruction, or for the use of the convents themselves. Careless and illegible writing is therefore but seldom to be met with among the remains of monastic industry; and when erasures were made, they appear to have been done with the utmost care and skill. For this purpose the Monks used pumice-stone; and they were also provided with a punctorium, or awl, to make the dots, and with metal pens for writing, until after the 7th century, when quills were brought into use for pens. Ink, composed of soot, or ivory-black, with gum, was used upon the vellum, for paper was not introduced until the tenth century. Hence the beautiful distinctness, as well as durability, of very ancient manuscript books. Indeed, such an important art was writing in those days considered, that Du Cange enumerates as many as a hundred different styles of writing in vogue among the learned.

With so many impediments to the multiplication of books as were attendant upon their slow production in this manner, it is not a matter of surprize that the monks enjoyed almost a monopoly of this kind of labor, as in truth they were the only body of men who could properly conduct it. The expense of books was proverbially great, and large estates were frequently set apart for the purpose of purchasing them. In addition to the cost of transcribing, the materials of which books were composed were sources of great expense. The leaves were, in many instances, composed of purple vellum, for the purpose of showing off to more advantage letters of gold and silver. The binding was often very gorgeous, although of a very rude construction. The most prevailing sort of covering for books was a rough white sheep-skin, pasted on a wooden board, with immense bosses of brass; but the exterior of those intended for the church service was inlaid with gold, relics, or silver or ivory plates. Some books had leaden covers, and some had wooden leaves; but even so early as the time of Froissart, binding in velvet, with silver clasps and studs, began to be adopted in presents to any very exalted personage. Illuminating manuscripts was also another occupation of the Monks of the middle ages, although not confined to them, for the greatest painters of the day disdained not to contribute to these cumbrous and sometimes confused decorations. The art of correct drawing, and a knowledge of perspective, cannot, however, be traced in the generality of the fantastic pictures by which illuminated books are adorned. Coloring and gilding appear to have been the chief points to which the attention of the illuminators was directed. The neutral tint was first laid on somewhat in the same mode

as at the present day, some portions being left untouched, in order to be afterwards embedded in gold and silver. The pictures represented different subjects, according to the nature of the book which they were intended to embellish. The title on the pages was formed of capital letters of gold and azure mixed. Illuminated pictures are of a dazzling brightness; the white predominating, which, not being an oil color, reflects the rays of light, and does not absorb them. So much custom had the monks in their labors of transcribing and illuminating, that they were sometimes obliged to introduce hired limners, although contrary to the monastic rule in general; but such aids were seldom resorted to, the monks being usually the only laborers. The invention of printing diminished the importance and annihilated the profits of writing; and, in 1460, that of engraving superceded the art of illuminating. The last specimen of this latter practice is to be met with at Oxford, in the Lectionary, or Code of Lessons for the Year, composed for Cardinal Wolsey. The achievement of this work, so long after printing and engraving had become popular, evinces how reluctant that great and splendid prelate was to relinquish a mode of framing books, which was certainly calculated to give them, in the eyes of the vulgar, an attractive and costly character. Illuminating is supposed to have originated from the necessity of rendering the means of knowledge attractive first to the senses, in those days of comparative darkness and ignorance. Besides transcribing and illuminating, the Monks excelled in sculpture and painting, turning, carpentry, jewellery, and goldsmith's work. Thomas de Bramburgh, a monk, of Durham, was even employed to make two great warlike engines for the defence of the town of Berwick, and an astronomical clock, made by Lightfoot, a monk, of Glastonbury, in 1325, is still preserved at Wells. Music, which Fuller, in his Church History, observes to "have sung its own dirge at the Reformation," was sedulously cultivated in the monastic institutions; and the Monks skilled in that accomplishment went from monastery to monastery, in order to disseminate their instructions.

Much might be said concerning the indefatigable attention paid by this class of men to the education of youth. This was a department in which, according to the notions of the time, they eminently excelled. In compliance with the prevalent superstitions, the learning of the service and rule of their respective orders was, it is true, the first point to be accomplished in the instruction of their pupils, the novices. These individuals, most of whom entered young, were required to commit the Psalter to memory, without deviating from a single word in the original: a painful exercise, which was the occupation of hours passed in the solitude of the cell. Latin, essential because the language of the Septuagint, was an object of incessant study, as well as French, which the Norman Conquest had introduced into common use in this country. To these studies were added writing and accounts, and several of the mechanical arts, besides some initiation into the popular pastimes of the day, and hunting, which was deemed salutary to the health. Probably more attention was paid to dexterity in these arts and accomplishments, than to the actual culture of the understanding. The Monks, though pre-eminent in architecture, as well as in most of the arts of life, made but little figure in literature, considering the leisure and opportunities which they enjoyed. For this, the routine-like nature of their existence may in some degree account. Nothing is so likely to damp the ardor of genius as a continual succession of formal observances, which dissipate the thoughts from any one great object. The minds of these recluses were also narrowed by localities. Pent up from general society, and in a small sphere, the interests, and often the contentions, which agitated their respective convents, became of paramount importance to them, and were mingled even with their historical records, with a degree of tasteless and absurd prolixity, which has much lessened the value of the few original works which they composed.

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The Lancasterian System in Greece, A. D. 1669.—We found about thirty young lads sitting upon benches, and their master at the head of them teaching them to read. His method was pretty, and much beyond ours; the master causing the whole class to read at a time without confusion, every scholar being obliged to attend, and to mind what his next neighbor reads. They had each of them the same author in his hand; and, for example, if he had thirty scholars, he chose out some continued discourse, and gave them but thirty words to read; the first boy reading the first word, the second boy the second word, the third boy the third

word, and so on. If they read soundly and right, he gave them thirty words more; but if any of the boys were out or imperfect, he was corrected by the next, who was always very exact in observing him, and he his neighbor, till the whole number of words were read. So that the thirty scholars, lying all of them at catch, and ready to take advantage of any defect in their neighbor, stimulated by an ambition of being thought the best scholar, every one's lesson was the lesson of all, and happy was he that could say it the best. To obviate any of the scholars in eluding that order, by preparing himself for any single words, their places were changed, and he who was at one reading in the first place was removed a greater distance in the next. Thus one lesson was enough for a whole form, how numerous soever, and which was very convenient for the master; the boys were not constrained to come to him one after another, for every one was a master to his neighbor.—[Guillatiere, quoted in Hennen's Medical Topography of the Mediterranean.]

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Decision of Character.—You may recollect the mention, in one of our conversations, of a young man who wasted in two or three years a large patrimony, in profligate revels with a number of worthless associates calling themselves his friends, till his means were exhausted, when they of course treated him with neglect or contempt. Reduced to absolute want, he one day went out of the house with an intention to put an end to his life; but wandering awhile almost unconsciously, he came to the brow of an eminence which overlooked what were lately his estates. Here he sat down, and remained fixed in thought a number of hours, at the end of which he sprang from the ground with a vehement exulting emotion. He had formed his resolution, which was that all these estates should be his again; he had formed his plan, too, which he instantly began to execute. He walked hastily forward, determined to seize the very first opportunity, of however humble a kind, to gain any money, though it were ever so despicable a trifle, and resolved absolutely not to spend, if he could help it, a farthing of whatever he might obtain. The first thing that drew his attention was a heap of coals shot out of carts on the pavement before a house. He offered himself to shovel or wheel them into the place where they were to be laid, and was employed. He received a few pence for the labor; and then, in pursuance of the saving part of his plan, requested some small gratuity of meat and drink, which was given him. He then looked out for the next thing that might chance to offer; and went with indefatigable industry through a succession of servile employments, of longer or shorter duration, still scrupulously avoiding, as far as possible, the expense of a penny. He promptly seized *every* opportunity which could advance his design, without regarding the meanness of occupation or appearance. By this method he had gained, after a considerable time, money enough to purchase, in order to sell again, a few cattle, of which he had taken pains to understand the value. He speedily, but cautiously, turned his first gains into second advantages; retained without a single deviation his extreme parsimony; and thus advanced by degrees into larger transactions and incipient wealth. I did not hear, or have forgotton, the continued course of his life: but the final result was, that he more than recovered his lost possessions, and died an inveterate miser, worth £60,000. I have always recollected this as a signal instance, though in an unfortunate and ignoble direction, of decisive character, and of the extraordinary *effect*, which, according to general laws belongs to the strongest form of such a character.—[Foster's Essays.]

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Anecdote of Benjamin Franklin.—Not long after Benjamin Franklin had commenced editor of a newspaper, he noticed with considerable freedom the public conduct of one or two influential persons in Philadelphia. The circumstance was regarded by some of his patrons with disapprobation, and induced one of them to convey to Franklin the opinion of his friends with regard to it. The Doctor listened with patience to the reproof, and begged the favor of his friend's company at supper, on an evening which he named; at the same time requesting that the other gentlemen who were dissatisfied with him should attend. The Doctor received his guests cordially—his editorial conduct was canvassed, and some advice given. Supper was at last announced, and the guests invited to an adjoining room. The table was only supplied with two puddings, and a stone pitcher filled with water. All were helped, none could eat but the Doctor. He partook freely of the pudding, and urged his friends to do the same; but it was out of the question—they tasted and tried in vain. When their

host saw the difficulty was unconquerable, he rose, and addressed them: 'My friends, any one who can subsist upon saw-dust pudding and water, as I can, needs no man's patronage.'—[Watson.]

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*History of Astronomy—its various Systems.*

[Continued from page 82.]

The Various Systems of Astronomy.—By the word System, in Astronomy, is meant a collection or assemblage of celestial bodies, connected with each other by certain or fixed laws.

The system of the world comprehends the sun, the planets, and comets.

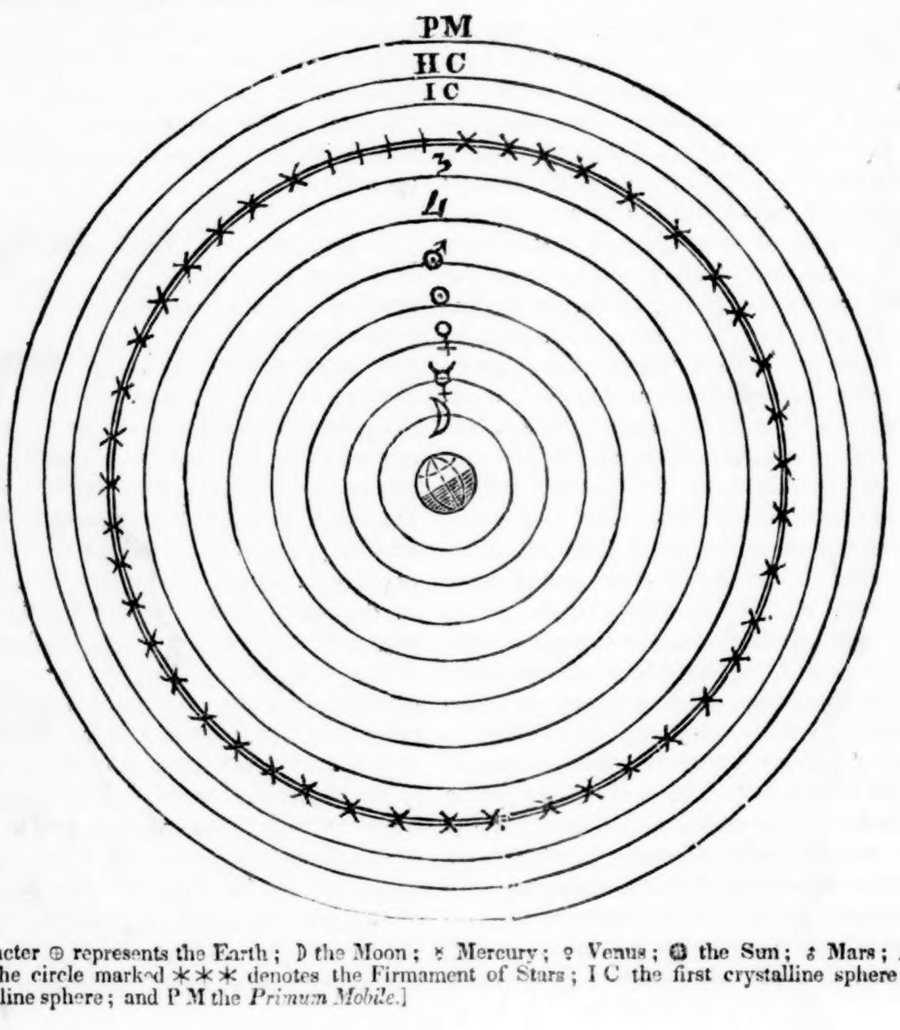
To explain the motions and appearances of these bodies, various hypotheses have, at different times, been formed; some of which have descended from the earliest periods to the present day, bearing the names of their respective inventors, and carry with them marks of very great powers of invention.

But in the earliest ages of the world, when men were ignorant of the laws of motion, it is scarcely to be expected that they could discover the true system of the universe, or explain all the various phenomena of the heavens. It is, however, believed, that the first opinions on this subject were much more just than those which were held afterwards for many years.

Pythagoras maintained that the Earth was a planet, and that the sun was fixed in the centre of the planetary system. This is now universally believed; but at that time was only the opinion of a few individuals of Greece, who durst not openly avow such unpopular doctrine. Hence, in a very short time, the very name of the Pythagorean system was almost buried in oblivion.

Ptolemaic System.—The first regular system of Astronomy that appeared in the world was the Ptolemaic, so called from Ptolemy, a native of Pelusium in Egypt, as already mentioned, who came to study in the school of Alexandria.

This system is represented by the following figure, where the concentric circles denote the orbits of the planets, &c.




[The character ⊕ represents the Earth; ☽ the Moon; ☿ Mercury; ♀ Venus; ☉ the Sun; ♂ Mars; ♃ Jupiter; ♄ Saturn. The circle marked ✳✳✳ denotes the Firmament of Stars; I C the first crystalline sphere; II C the second crystalline sphere; and P M the *Primum Mobile*.]

This system does not seem to have been originally invented by him, but adopted as the prevailing one of the age, which he digested into a system, more regular and consistent than any thing hitherto known on that subject. He supposed the Earth to be fixed immoveably in the centre of the universe, and that the sun, moon, and planets, moved round it. That above the planets were placed the firmament of stars, then two crystalline spheres, all of which were included in the *primum mobile*, which was, by some unaccountable means, turned round once in twenty-four hours, carrying all the rest along with it.

It is easy to see that the confused motions of the planets here stated could never be accounted for on any thing like *rational* principles. Had the planets circulated uniformly round the Earth, their apparent motions ought always to have been equal and uniform, without appearing either stationary or retrograde.

In consequence of this objection, Ptolemy was obliged to invent a great many circles interfering with each other, which he called Epicycles and Eccentrics. These proved an excuse for all the defects of his system; for, when any of the planets were deviating from the course they ought to have kept, they were then only moving in an epicycle or eccentric! But as to the natural cause which directed any of these bodies to move in these epicycles, he was at a loss to account, and was obliged to have recourse to Divine power for an explanation; or in other words, to own that his system was unintelligible.

If this system were true, the two planets nearest the sun, Mercury and Venus, could never be hid behind the sun, as their orbits are included in his, (according to Ptolemy's hypothesis,) and these two planets would always move direct, and be as often in opposition as in conjunction with him. But the contrary of all this takes place: for these two planets are just as often behind the sun as before him; appear as often to move backward as forward; and are so far from being seen at any time in the side of the heavens opposite to the sun, that they were never yet seen a quarter of a circle in the heavens distant from him: which proves that this system is contrary to what actually takes place.

Yet it continued to be in vogue till the beginning of the sixteenth century, when Copernicus, a native of Thorn, in Prussia, made his appearance. This man began, in the early part of his life, to try whether a more satisfactory manner of accounting for the apparent motions of the heavenly bodies could not be discovered, than what was given by Ptolemy. From intense application to the subject, and a few hints obtained from the ancients, he at last deduced a most complete system, capable of solving every phenomenon in a more satisfactory manner than was ever done before. This system is still called the

Copernican System.—In this system the sun is supposed to be placed in the centre; next him revolves the planet Mercury, then Venus, next the Earth with the Moon; beyond these, Mars, Jupiter, and Saturn, and far beyond the orbit of Saturn is placed the fixed stars, which form the boundary of the visible creation. (See solar system.)

Copernicus concluded, that if the Earth revolved every day round its axis from *west* to *east*, all the heavenly bodies would appear to revolve in a contrary direction, namely, from *east* to *west*. The diurnal revolution of the heavens, upon this hypothesis, would be only apparent; the firmament, which has no other sensible motion, would be perfectly at rest; while the sun, the moon, and the five planets, would have no other motion beside that eastward revolution which is peculiar to them. By supposing the Earth to revolve with the planets round the sun in an orbit which included the orbits of Venus and Mercury, but included in those of Mars, Jupiter, and Saturn, he could, without the embarrassment of epicycles, connect together the apparent annual revolutions of the sun, and the direct, retrograde, and stationary appearances of the planets; and by supposing the axis of the Earth a little inclined to the plane of its orbit, and to remain always parallel to itself, he could also account for the obliquity of the ecliptic, the sun's apparent progression from north to south, the consequent change of seasons, and the different lengths of days and nights, &c.

Though this system was received by most men of science then living, yet there were some who would never assent to it. The motion of the Earth was so contrary to what they were always accustomed to hear on that subject, and, as they thought, to appearances, that they could never agree to support such doctrine.

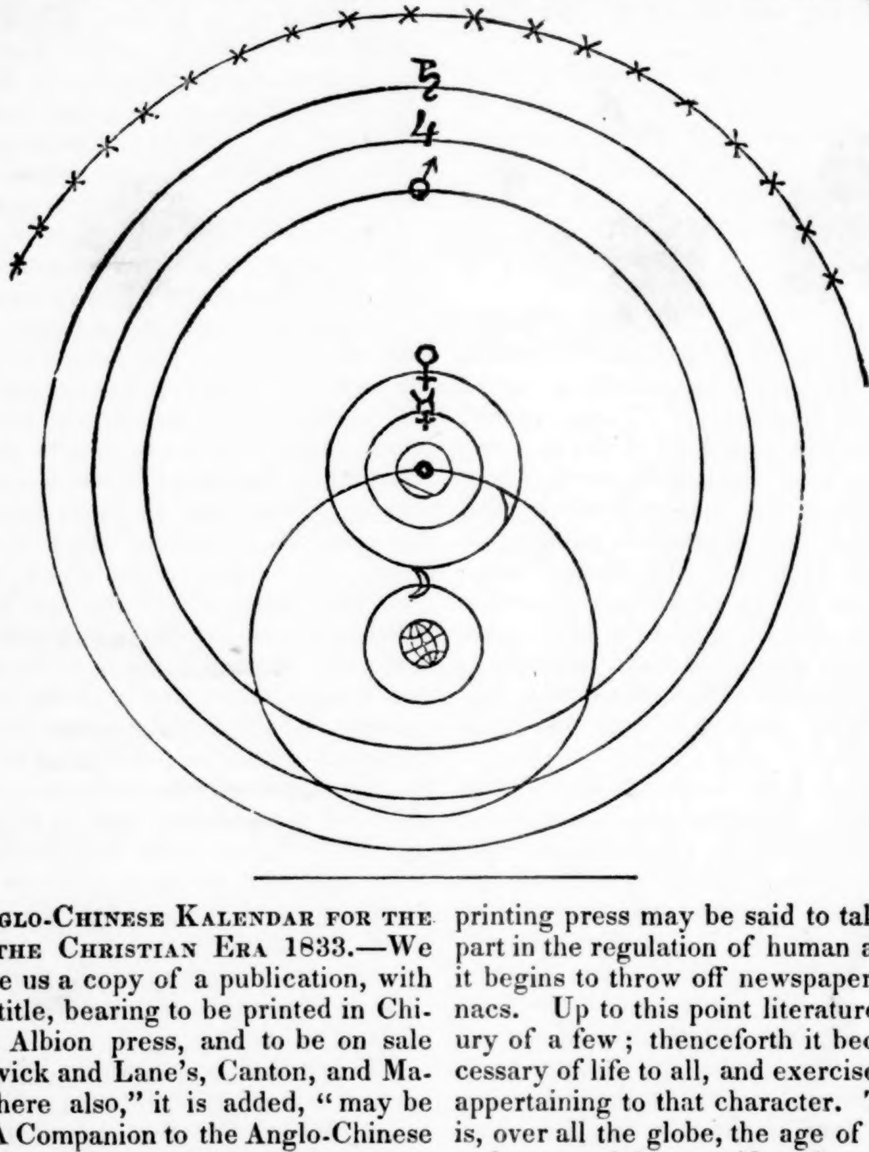
Among those who opposed the system of Copernicus, was the celebrated astronomer Tycho Brahe, who has already been men-

tioned as having greatly contributed to improve the science of Astronomy, by the number of observations which he made, and the excellent apparatus he caused to be constructed for his observatory. As he could not entirely adopt the Ptolemaic, and being a man of genius, he invented another system, which was a kind of mean between the Ptolemaic and the Copernican.

Tychonic System.—According to Tycho Brahe, the inventor of this system, the Earth is supposed to be the centre of the orbits of the sun and moon; but the sun is supposed to be the centre of the orbits of the five primary planets then known. These orbits are represented by the figure annexed.

Thus, according to Tycho Brahe, the sun and all the planets moved round the Earth, in order to save the Earth from turning round her axis once in twenty-four hours.

This system, so repugnant to all the laws of Mechanics, was never very generally adopted, and is now mentioned only to be ridiculed. Tycho's true glory consisted in having been an excellent observer, and not in being the inventor of a new system.



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The Anglo-Chinese Kalendar for the Year of the Christian Era 1833.—We have before us a copy of a publication, with the above title, bearing to be printed in China, at the Albion press, and to be on sale "at Markwick and Lane's, Canton, and Macoa;" "where also," it is added, "may be obtained, A Companion to the Anglo-Chinese Kalendar for 1832, containing various commercial and other tables, many of which continue applicable to the present time." The price of the Companion is one Spanish dollar, that of the Kalendar half as much, or 50 cents. We regard this production as a very great curiosity, and as one of the most interesting signs of the times. The printing press may be said to take a decided part in the regulation of human affairs, when it begins to throw off newspapers and almanacs. Up to this point literature is the luxury of a few; thenceforth it becomes a necessary of life to all, and exercises the power appertaining to that character. The present is, over all the globe, the age of this its new and more mighty manifestation. It is some years since a newspaper, printed partly in the native tongue of the tribe, was established among the Cherokees of North America. There is more than one newspaper now published in the popular dialect of India. Even the Turks now have their printed newspaper; and here we have an Al-

manac and Companion printed in China, where we believe an English newspaper has also been for some time published. This country, indeed, is the native land of the art of printing, which was practised here many centuries before it was known in Europe; but yet, all circumstances considered, the appearance of an English Almanac from the press of Canton is perhaps more remarkable than any of the other novelties we have mentioned.

The Anglo-Chinese Kalendar commences by some introductory remarks on the Chinese year, which is luni-solar—that is to say, is regulated by the motions of the moon, but is accommodated also, in a rude and imperfect way, to that of the sun, by the insertion, or intercalation, as it is called, of an occasional thirteenth month, when requisite. The year 1833 of our reckoning corresponds to the Chinese year *Kwei-sze*, or the thirtieth of the 75th cycle of sixty, which commenced on the 20th of February, and is the thirteenth of the reigning Emperor Taoukwang. The Chinese week consists, like our own, of seven days, one of which is kept as a holiday or sabbath.

The present Kalendar is drawn up according to the European form, and contains, besides notices of anniversaries, a list of festivals and remarkable days, comprehending most of those observed either in China or Christendom. Some notes are appended, explanatory of the Chinese festivals, from which we shall give one or two extracts. The following is the note on the festival of Spring, or the Leih-chun term-day, being the 15th day of the 12th moon, which this year fell on the 4th of February: "This day, the period of the sun's reaching the 15th degree in Aquarius, is one of the chief days of the Chinese Kalendar, and is celebrated with great pomp, as well by the government as by the people. In every capital city there are made, at this period, two clay images, of a man and a buffalo. The day previous to the festival, the chefoo, or chief city-magistrate, goes out to *ying chun*, meet spring; on which occasion children are carried about on men's shoulders, each vying with his neighbor in the gorgeousness and fancifulness of the children's dresses. The following day, being the day of the festival, the chefoo again appears as priest of spring, in which capacity he is, for the day, the first man in the province. Hence the chief officers do not move from home on this day. After the chefoo has struck the buffalo with a whip two or three times, in token of commencing the labors of agriculture, the populace then stone the image till they break it in pieces. The festivities continue ten days."

The 20th of February, as already mentioned, was this year the new-year's day of the Chinese. It is called by them Yuen tan, or "the first morning." "The period of new year," says the Kalendar, "is almost the only time of universal holiday in China. Other times and seasons are regarded only by a few, or by particular classes, but the new year is accompanied with a general cessation of business. The officer, the merchant, and the laborer, all equally desist from work, and zealously engage in visiting and feasting,—occasionally making offerings at the temples of those deities whose peculiar aid they wish to implore. Government offices are closed for about ten days before, and twenty days after new year; during which period none but very important business is transacted. On the last evening of the old year, all tradesmen's bills and small debts are paid. This is perhaps the reason why it is called *choo seih*, the evening of dismissal."

We may add the account of the festival of dragon boats, called in Chinese Twan-woo or Twang-yang, and also Teen-chung, falling this year on the 22d of June. "On this day many people race backwards and forwards, in long narrow boats, which being variously painted and ornamented, so as to resemble dragons, are called *lung chuen*, 'dragon boats.' From the narrowness of the boats, and the number of persons on board, there being sometimes from sixty to eighty oars, or rather paddles, it frequently happens that several of the boats break in two; so that the festivities seldom conclude without loss of several lives. Tradesmen's accounts are cleared off at this period."

The Chinese, we find, have their immortal Francis Moore as well as ourselves. The 5th of July, being the eighteenth day of the fifth moon, is the birth-day of the astronomer Chang, of whom the following account is given: "This individual, who formerly superintended the making of the Chinese Kalendar, is supposed still to exist, and to predict eclipses, and other astronomical, as well as astrological, phenomena."

The most interesting part of this Kalendar, however, is its account of the Chinese seasons, given in the form of notices at the head of each month. It may be presumed that, prepared as they are in the country to

which they refer, the correctness of these descriptions may be depended on; and we shall therefore give the whole.

"*January.*—The weather during the month of January is dry, cold, and bracing; differing but little, if at all, from the two preceding months, November and December. The wind blows generally from the north, occasionally inclining to north-east or north-west. Any change to south causes considerable variation in the temperature of the atmosphere.

"*February.*—During this month the thermometer continues low; but the dry, bracing cold of the three preceding months is changed for a damp and chilly atmosphere. The number of fine days is much diminished, and cloudy or foggy days are of more frequent recurrence in February and March than in any other months. At Macao the fog is often so dense as to render objects invisible at a very few yards distance.

"*March.*—The weather in the month of March is also damp and foggy, but the temperature of the atmosphere becomes considerably warmer. To preserve things from damp, it is requisite to continue the use of fires and closed rooms, which the heat of the atmosphere renders very unpleasant. From this month the thermometer increases in height until July and August, when the heat is at its maximum.

"*April.*—The thick fogs which begin to disappear towards the close of March are in April seldom if ever seen. The atmosphere, however, continues damp, and rainy days are not unfrequent. At the same time the thermometer gradually rises, the nearer approach of the sun rendering its heat more perceptible. In this and the following summer months, south-easterly winds generally prevail.

"*May.*—In this month summer is fully set in, and the heat, particularly in Canton, is often oppressive; the more so from the closeness of the atmosphere, the winds being usually light and variable. This is the most rainy month in the year, averaging fifteen days and a half of heavy rain; cloudy days without rain are, however, of unfrequent occurrence; and one half of the month averages fair sunny weather.

"*June.*—June is also a very wet month, though, on an average, the number of rainy days is less than in the other summer months. The thermometer in this month rises several degrees higher than in May, and falls but little at night. It is this circumstance, chiefly, which occasions the exhaustion often felt in this country from the heat of summer.

"*July.*—This month is the hottest in the year, the thermometer averaging eighty-eight in the shade at noon, both at Canton and Macao. It is likewise subject to frequent heavy showers of rain; and, as is also the month of August, to storms of thunder and lightning. The winds blow almost unintermittingly from south-east or south.

"*August.*—In this month the heat is generally as oppressive, and often more so, than in July, although the thermometer usually stands lower. Towards the close of the month the summer begins to break up, the wind occasionally veering from south-east to north and north-west. Typhons seldom occur earlier than this month, or later than the end of September.

"*September.*—In this month the monsoon is entirely broken up, and northerly winds begin to blow, but with little alleviation of heat. This is the period most exposed to the description of hurricanes called Typhons, the range of which extends southwards, over about one half of the Chinese sea, but not far northward. They are most severe in the Gulf of Tonquin.

"*October.*—Northerly winds prevail during the month of October, occasionally veering to the north-east or north-west; but the temperature of the atmosphere is neither so cold nor so dry as in the following months. Neither does the northerly wind blow so constantly, a few days of southerly wind frequently intervening. The winter usually sets in with three or four days of drizzling rain.

"*November.*—This month and the following are the pleasantest in the year, to the feelings, at least, of persons from more northern climes. Though the thermometer is not often below forty, and seldom so low as thirty, the cold of the Chinese winter is often intense. Ice sometimes forms about one-eighth of an inch thick, but this is usually in December or January.

"*December.*—The months of December and January are remarkably free from rain; the average fall in each month being under one inch, and the average number of rainy days being only three and a half. On the whole, the climate of Canton, but more especially of Macao, may be considered very superior to that of most other places situated between the tropics."

The following table presents a view of the range of the thermometer at Canton:

| | Average, Noon. | Average, Night. | Highest. | Lowest. |
|---|---|---|---|---|
| January . . . | 64 | 50 | 74 | 29 |
| February . . | 57 | 49 | 78 | 38 |
| March . . . | 72 | 60 | 82 | 44 |
| April . . . | 77 | 68 | 86 | 55 |
| May . . . . | 78 | 72 | 88 | 64 |
| June . . . . | 85 | 79 | 90 | 74 |
| July . . . . | 88 | 81 | 94 | 79 |
| August . . . | 85 | 78 | 90 | 75 |
| September . . | 83 | 76 | 88 | 70 |
| Ootober . . . | 77 | 69 | 85 | 57 |
| November . . | 67 | 57 | 80 | 40 |
| December . . | 62 | 52 | 70 | 45 |

[Penny Magazine: C. Knight, London.]

Silk Manufacture.—One of the most gratifying exhibitions we ever witnessed is that of the silk-worm in all its stages, with the mulberry-leaves, eggs, cocoons, chrysalis, miller, &c. together with a complete domestic process of manufacture, which may be seen at the Agricultural Warehouse, North Market street, Boston. The machine which is there in motion was invented last winter, by Mr. Adam Brooks, of Scituate, Massachusetts, and a patent of it, which we have seen, was issued on the late 29th of June. It is an improvement, as it seems to us, of vast importance; for, unlike the Piedmontese Wheel, heretofore chiefly used, which only performed the reeling process, *it combines the reeling and twisting;* and the saving of labor is such, in consequence, that 150 skeins can be made in a day by one woman, and a little girl, to turn this improved wheel, as easily as 40 can by the old. This we learn from those who have tried both. One of the new machines is used in Connecticut, and another in New-York, besides those in the family of the ingenious inventor, who now devote their time, in a great measure, to this business.

Mr. Brooks is one of the Society of Friends. His wife, who superintends the wheel, and has paid some attention to silk-making for several years, had made frequent complaints of the labor lost by the old machine. Her husband doubted the practicability of amending it, and told her so in plain terms—but went to thinking, it seems, and in about three weeks produced this capital improvement. Mrs. Brooks says it was formerly a very hard day's work to make 30 skeins; she can now make 100 in ordinary hours. The silk is beautiful, as smooth as the Italian itself—and stronger than that. We challenge the strongest-fingered editor in the city to break a thread of it. If he succeeds, he shall have one of the silk handkerchiefs we engaged this morning—socks and all. —[Boston paper.]

New Motive Power.—Dr. Ritchie, in one of his recent lectures on electro-magnetism, at the Royal Institution, proved by experiments that, by suddenly changing the poles of an electro-magnet, a bar of soft iron might be made to revolve with considerable force about its centre, thus obtaining a prime mover, which may probably be applied to useful purposes.

Architecture.—The study of architecture is an art interesting and instructive, and more especially so to most of the readers of this magazine, many of whom are practically engaged in various branches of it. As several of our subscribers have expressed their satisfaction at seeing introduced into its columns those articles on the subject which have been inserted, we purpose following them up, by occasionally introducing further illustrations of them, in the form of question and answer, from an excellent little book* published in England by Robt. Brindley, Architect and Engineer.

Q. What is Civil Architecture?

A. An art that treats of the designing and erection of different edifices, constructed upon certain established rules.

Q. Whence its origin?

A. Vitruvius, who flourished a little before the Christian era, says, "anciently men lived in woods and caverns; but in time, taking example perhaps from birds, who with great industry built their nests, they made themselves huts, composed of the branches of trees, covering them with reeds, leaves, and clay, to screen them from tempest and rain."

Q. What progress was made in the art of building?

* A Compendium of Civil Architecture, arranged in Questions and Answers, with Notes, embracing History, the Classics, and the Early Arts, more particularly extended in the English Styles, and the Grecian and Roman Orders, with Definitions and Illustrations; also, a Demonstration of the several parts of, and branches in, Practical Architecture, improved by miscellaneous matter: to which are appended the outlines of Geometry, definitions in Perspective, useful Memoranda for the Surveyor, as connected with Building, the Admeasurement of Artificers' works, forms of Specifications, Estimates, Contracts, and Tenders, and a Technical Vocabulary. By Robert Brindley, Architect, Surveyor, and Engineer, Author of the "Compendium of Naval Architecture," &c.—Devonport: W. Colman, Printer to his Majesty. Longwood & Co. and Simpkin & Marshall, London; Constable & Co., Edinburgh; Edwards & Savage, Cork; Hinton, Philadelphia; and Colman, New-York. 1832.

A. Improvements insensibly occurred in making the huts lasting, handsome, and convenient; the several component parts and projections affording ideas for ornaments.

Q. Is the origin of Civil Architecture to be ascribed to any single nation?

A. No. The primitive ideas of men of all nations assimilate so much in supplying the necessities of nature, that we are to look to those inhabitants where civilization has spread its benignant rays over the dark regions of barbarity.*

Q. How may the different grades of Civil Architecture be enumerated?

A. Egyptian, Indian, Persian, Phœnician, Hebraic, Chinese, Greek, Etruscan, Roman, Gothic, Moorish or Saracenic, Saxon, and English.†

Q. Who were the earliest cultivators of architecture, as a fine art?

A. Probably the Assyrians, whose empire was founded by Ninus, 2059 A. C.

Q. What was the capital of the empire?

A. Babylon; founded 2247 A. C. by a son of Belus, whose name it bore.

Q. What description does Pliny give of it?

A. That it was a most magnificent city; being 60 miles in circumference. Its walls were 200 feet high, and 50 feet wide, cemented by bitumen.‡

Q. What other city is made mention of in Assyria?

A. The city of Nino (in Scripture Nineveh), built on the banks of the Tigris, by Ninus.

Q. What description is given of it by Diodorus Siculus?§

A. It was of vast extent; being 15 miles long, 9 broad, and 48 in circumference; like Babylon, it was surrounded by walls 100 feet high, on the top of which three chariots could pass together abreast. This city was defended by 1500 towers, each 200 feet high.

Q. What remarkable building is also worthy of notice?

A. The famed temple of Jupiter Belus, the most ancient and magnificent in the world, and once the *Tower of Babel*. Pliny makes mention of its remains, as standing in his time, A. D. 70. It had lofty towers, and was enriched by all the succeeding monarchs, until Xerxes demolished it about 420 A. C. Among the riches it contained were many statues of massy gold, one of which was 40 feet high.*

* It is singular that tradition has not handed down, by Noah and his sons, the art of building in the antediluvian style, which we have every reason to expect was carried to a gigantic extent, by the vast population existing, and the cultivation of the several arts.

† By some writers the rise and progress of Architecture have been divided into eight epochs, descending to the present period.

‡ A kind of fat clay or slime, clammy, like pitch, and in smell somewhat like brimstone.

§ A historian, born in Sicily, who flourished 44 years A. C.

EGYPTIAN.

Q. Whither did the arts pass from the Assyrian kingdom?

A. To Egypt, one of the most ancient nations in the world; the foundation being begun under Mizraim, the son of Ham, 2188 A. C.†

Q. What is the character of the Egyptian Architecture?

A. Massive solidity, marked by very great stiffness of contour, tinged by a sepulchral cast.

Q. To what must this peculiarity of character be attributed?

A. Perhaps emanating from the constant excavation of the rock by the inhabitants, to obtain shelter from the burning heat of the sun, aided by their constitutional grave dispositions, and also the ponderous materials naturally produced.

Q. What are the buildings peculiar to Egypt?

A. Those most stupendous fabrics of art, the pyramids, the largest of which stands near Grand Cairo, forming a square, each side of its base being 660 feet, and nearly 500 feet high. Large stones, 30 feet long, are used therein.

Q. For what purpose were these pyramids constructed?

A. As sepulchres for kings; the impressions of the Egyptian mind being, that, so long as the body could be preserved from decay, the soul remained with it,—this also may be still further explained by the care taken of the mummy.

Q. What other buildings come under immediate notice?

A. The Labyrinth at Crocodilopolis, that immense collection of halls, as described by Herodotus and others; the monolithal chamber, constructed of a single stone; the obelisks, (angular pillars,) one of which was removed to Rome, and stands near the church of St. John of Leteran, 178 feet high; Cleopatra's needles, near Alexandria; and the colossal figure of the Sphynx of Ghiza, said

* Josephus, Herodotus, Strabo, Arrian, Diod. Sic.

† About this time Troy was supposed to have been founded by Dardanus.

to have been the sepulchre of the Egyptian king Amasis,* and is one entire stone, being sculptured out of a solid rock.

Q. What of the Egypti in temples?

A. They were magnificent buildings, covered with hieroglyphics, paintings, and sculptures, and preceded by ranges of carved animals, sphynxes, and obelisks.

Q. What description is given of these temples?

A. The walls of them were immensely thick, in order to support the roofs, which consisted of very large stones laid flat, and were further supported in the centres by a vast number of pillars, which presented squares, octagons, sixteen-faces, and frequently circles. These pillars also differed in size, having no base, or a very trifling one; the capital was either a square slab with hieroglyphics, adorned with foliage, representing a vase, or a bell reversed. The intercolumniation rarely exceeded three feet, or three feet six inches.

Q. Of what form were the doors and windows?

A. Trapezoidal, diminishing at the heads, or as Dr. Pococke calls them, pyramidical.

Q. What remaining temple still claims notice?

A. The temple of Memnon, at Thebes, of extraordinary dimensions and massiveness.

Q. What specimens of this order of architecture have we in our country?

A. The Egyptian Hall, Piccadilly.

Q. What of the city of Thebes?

A. In the time of its splendor it extended 23 miles, and had 100 gates, with a vast population. Thebes was ruined by Cambyses, 515 A. C., and few traces of it were seen in the age of Juvenal, A. D. 120.

Q. Has the Egyptian architecture undergone any variation from its primitive display?

A. Yes, materially, under the Ptolemies; their buildings were constructed on Grecian art—Grecian artists being employed in designing for them, reserving the original character of the country. Hence it may be concluded, that the Egyptian order is that from which all others have emanated.

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MECHANICAL INVENTION.—The writer of this, while on a visit to the penitentiary, near the city of Trenton, New-Jersey, a few days ago, witnessed the operation of a machine for punching holes in bars of iron, which worked with extraordinary effect. It is a simple machine, easily constructed, at very little expense, and capable of being moved about and used in any position. It was employed in punching the holes for the perpendicular bars which are inserted through the flat cross bars for the iron grating to be used in the windows and doors of the new State Penitentiary. We noticed that in the space of one minute and a quarter, seven holes were perforated through a bar half an inch thick, each hole being one and a quarter inches in diameter—the bar being perfectly cold at the time. This effect is produced by the application of a lever power, and two or three rapid blows with a sledge hammer. This is certainly an important discovery in this branch of mechanics, and is the invention of some of the gentlemen engaged in the erection of the new Penitentiary.—[Emporium.]

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*Ingenuity of the Spider.* [Communicated for the New-York Farmer, and American Gardener's Magazine.]

MR. EDITOR,—I have thought it might be interesting to your readers, and consequently to yourself, to read the following statement of a fact which came within my observation recently in Brooklyn.

On passing along one of my garden walks the other day, I discovered a spider's web constructed rather singularly. It was suspended from a cherry tree, being attached to the trunk, and running out with numerous fastenings, at different distances, on a large limb, which rose at an angle of perhaps 30 degrees from the earth. This you may suppose would make the web of rather a narrow triangle, and one not likely to bring the proprietor much custom. To enlarge its sweep, however, the spider had, by some means or other, formed a corner downward, and suspended from it a little stone, say half an inch in length, three-eighths in width, and one-eighth in thickness, well secured in pa-

* A man who rose from a common soldier.

rachute style, and hanging some eight or ten inches below. This weight kept the web taut, and swung slightly as the wind affected it; and there it remained for several days. I had some curiosity to know more of the projector of this contrivance, and on casting my eye near the tree, where the thickening fabric indicated that he kept his counting-room, I discovered a spider with a body nearly spherical, and of the size of a small cherry, about half an inch through, with crab-legs, and in all respects appearing ready for business. I touched him slightly with a little stick, upon which he made a motion towards it so sudden and so impassioned as well nigh made me jump, at the same time striking the stick in such a manner that inclines me to think, had it been animated, it would have felt his venom.

I am ignorant of the branch of natural history, as well as of some others, and know not the class to which this spider may belong; nor whether this mode of securing a web may not have been frequently observed by others. But the case to me being new, I submit it to you, with the hope that it may elicit remarks from those who are better informed than myself on the subject.

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Columbus and the Egg.—Pedro Gonzalez de Mendoza, the Grand Cardinal of Spain, invited Columbus to a banquet, where he assigned him the most honorable place at table, and had him served with the ceremonies which, in those punctilious times, were observed towards sovereigns. At this repast is said to have occurred the well-known anecdote of the egg. A shallow courtier present, impatient of the honors paid to Columbus, and meanly jealous of him as a foreigner, abruptly asked him whether he thought that, in case he had not discovered the Indies, there were not other men who would have been capable of the enterprize. To this Columbus made no immediate reply, but, taking an egg, invited the company to make it stand upon one end. Every one attempted it, but in vain, whereupon he struck it upon the table so as to break the end, and left it standing on the broken part; illustrating, in this simple manner, that when he had once shown the way to the New World, nothing was easier than to follow it. This anecdote rests on the authority of the Italian historian Benzoni. It has been condemned as trivial, but the simplicity of the reproof constituted its severity, and was characteristic of the practical sagacity of Columbus. The universal popularity of the anecdote is a proof of its merit.—[Washington Irving's Life of Columbus.]

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Cryptography: the art of transmitting secret information by means of writing, which is intended to be illegible, except by the person for whom it is destined. The ancients sometimes shaved the head of a slave, and wrote upon the skin with some indelible coloring matter, and then sent him, after his hair had grown again, to the place of his destination. This is not, however, properly secret writing, but only a concealment of writing. Another sort, which corresponds better with the name, is the following, used by the ancients. They took a small stick and wound around it bark, or papyrus, upon which they wrote. The bark was then unrolled and sent to the correspondent, who was furnished with a stick ot the same size. He wound the bark again, round this, and thus was enabled to read what had been written.

This mode of concealment is evidently very imperfect. Cryptography properly consists in writing with signs, which are legible only to him for whom the writing is intended, or who has a key or explanation of the signs. The most simple method is to choose for every letter of the alphabet some sign, or only another letter. But this sort of cryptography (*chiffre*) is also easy to be deciphered without a key. Hence many illusions are used. No separation is made between the words, or signs of no meaning are inserted among those of real meaning. Various keys, likewise, are used, according to rules before agreed upon. By this means, the decyphering of the writing becomes difficult for a third person, not initiated; but it is likewise extremely troublesome for the correspondents themselves; and a slight mistake often makes it illegible, even by them.

Another mode of communicating intelligence secretly, viz. to agree upon some printed book, and mark the words out, is also troublesome and not at all safe. The method of concealing the words which are to convey the information intended in matter of a very different character, in a long letter, which the correspondent is enabled to read, by applying a paper to it, with holes corresponding to the places of the significant words, is attended with many disadvantages: the paper may be lost; the repetition of certain words may lead to discovery; and the difficulty of connecting the impor-

tant with the unimportant matter, so as to give the whole the appearance of an ordinary letter, is considerable. If this is effected, however, this mode has the advantage of concealing the fact that any secrecy is intended.

Writing with sympathetic ink, or milk, lemon juice, &c. is unsafe, because the agents to make the letters visible are too generally known. Hence the *chiffre quarre*, or *chiffre indechiffrable*, so called, has come very much into use, because it is easily applied, difficult to be decyphered, and the key may be preserved in the memory merely, and easily changed. It consists of a table, in which the letters of the alphabet, or any other signs agreed upon, are arranged under one another, thus:

| | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| z | a | b | c | d | e | f | g | h | i | k | l | m | n | o | p | q | r | s | t | u | v | w | x | y | z |
| a | b | c | d | e | f | g | h | i | k | l | m | n | o | p | q | r | s | t | u | v | w | x | y | z | a |
| b | c | d | e | f | g | h | i | k | l | m | n | o | p | q | r | s | t | u | v | w | x | y | z | a | b |
| c | d | e | f | g | h | i | k | l | m | n | o | p | q | r | s | t | u | v | w | x | y | z | a | b | c |
| d | e | f | g | h | i | k | l | m | n | o | p | q | r | s | t | u | v | w | x | y | z | a | b | c | d |
| e | f | g | h | i | k | l | m | n | o | p | q | r | s | t | u | v | w | x | y | z | a | b | c | d | e |
| f | g | h | i | k | l | m | n | o | p | q | r | s | t | u | v | w | x | y | z | a | b | c | d | e | f |
| g | h | i | k | l | m | n | o | p | q | r | s | t | u | v | w | x | y | z | a | b | c | d | e | f | g |
| h | i | k | l | m | n | o | p | q | r | s | t | u | v | w | x | y | z | a | b | c | d | e | f | g | h |
| i | k | l | m | n | o | p | q | r | s | t | u | v | w | x | y | z | a | b | c | d | e | f | g | h | i |
| k | l | m | n | o | p | q | r | s | t | u | v | w | x | y | z | a | b | c | d | e | f | g | h | i | k |
| l | m | n | o | p | q | r | s | t | u | v | w | x | y | z | a | b | c | d | e | f | g | h | i | k | l |
| m | n | o | p | q | r | s | t | u | v | w | x | y | z | a | b | c | d | e | f | g | h | i | k | l | m |
| n | o | p | q | r | s | t | u | v | w | x | y | z | a | b | c | d | e | f | g | h | i | k | l | m | n |
| o | p | q | r | s | t | u | v | w | x | y | z | a | b | c | d | e | f | g | h | i | k | l | m | n | o |
| p | q | r | s | t | u | v | w | x | y | z | a | b | c | d | e | f | g | h | i | k | l | m | n | o | p |
| q | r | s | t | u | v | w | x | y | z | a | b | c | d | e | f | g | h | i | k | l | m | n | o | p | q |
| r | s | t | u | v | w | x | y | z | a | b | c | d | e | f | g | h | i | k | l | m | n | o | p | q | r |
| s | t | u | v | w | x | y | z | a | b | c | d | e | f | g | h | i | k | l | m | n | o | p | q | r | s |
| t | u | v | w | x | y | z | a | b | c | d | e | f | g | h | i | k | l | m | n | o | p | q | r | s | t |
| u | v | w | x | y | z | a | b | c | d | e | f | g | h | i | k | l | m | n | o | p | q | r | s | t | u |
| v | w | x | y | z | a | b | c | d | e | f | g | h | i | k | l | m | n | o | p | q | r | s | t | u | v |
| w | x | y | z | a | b | c | d | e | f | g | h | i | k | l | m | n | o | p | q | r | s | t | u | v | w |
| x | y | z | a | b | c | d | e | f | g | h | i | k | l | m | n | o | p | q | r | s | t | u | v | w | x |
| y | z | a | b | c | d | e | f | g | h | i | k | l | m | n | o | p | q | r | s | t | u | v | w | x | y |
| z | a | b | c | d | e | f | g | h | i | k | l | m | n | o | p | q | r | s | t | u | v | w | x | y | z |

Any word is now taken for a key: *Paris*, for example. This is a short word, and, for the sake of secrecy, it would be well to choose for the key some one or more words less striking. Suppose we wish to write in this cypher, with this key, the phrase "We lost a battle;" we must write *Paris* over the phrase, repeating it as often as is necessary, thus:

*P a r i s P a r i s P a r*
W e l o s t a b a t t l e

We now take, as a cypher for *w*, the letter which we find in the square opposite *w*, in the left marginal column, and under *p* on the top, which is *m*. Instead of *e*, we take the letter opposite *e*, and under *a*, which is *f*; for *l*, the letter opposite *l*, and under *r*, and so on.

Proceeding thus, we should obtain the following series of letters:

m f c x l i b t k m i m w

The person who receives the epistle writes the key over the letters: as,

*P a r i s P a r i s P a r*
m f c x l i b t k m i m w

He now goes down in the perpendicular line, at the top of which is *p*, until he meets *m*, opposite to which, in the left marginal column, he finds *w*. Next, going in the line of *a*, down to *f*, he finds on the left *e*. In the same way, *r* gives *l*, *i* gives *o*, and so on. Or you may reverse the process: begin with *p*, in the left marginal column, and look along horizontally till you find *m*, over which, in the top line, you will find *w*. It is easily seen that the same letter is not always designated by the same cypher; thus, *e* and *a* occur twice in the phrase selected, and they are designated respectively by the cyphers *f* and *w*, *b* and *k*. Thus the possibility of finding out the secret writing is almost excluded. The key may be changed from time to time, and a different key may be used with each correspondent. The utmost accuracy is necessary, because one character,

accidentally omitted, changes the whole cypher. The correspondent, however, may ascertain this with considerable trouble.—[British Cyclopædia.]

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*History of Chemistry.* [Continued from page 136.]

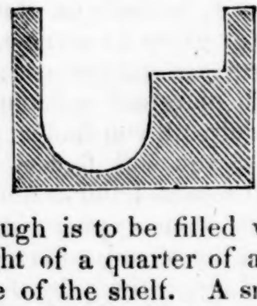
Muriatic Acid.—According to Dr. Thomson there are only two simple incombustible substances which unite to oxygen, viz. Azote and Muriatic Acid; the former of these has already been treated of, and the second we shall make the subject of the present article.

The *name* muriatic acid is taken from the substance which most plentifully affords it, namely, sea or marine salt, the *muria* of the Latins. This name is given to it, because its radical, or base, has not yet been discovered in nature. Before the framing of the methodical nomenclature, it was called *spirit of salt, marine acid,* and sometimes *acid of salt.*

The muriatic acid exists abundantly in nature in combination with common salt and the waters of the ocean. And though we are almost witnesses of this formation, we are yet unacquainted with the principles employed by nature, the proportion in which she combines them, and the mode in which the combination is effected.

Muriatic acid may be procured by the following processes:

Let a small pneumatic trough be procured, hollowed out of a single block of wood; about 15 inches long, 7 broad, and 6 deep. After it has been hollowed out to the depth of an inch, leave three inches by way of a shelf on one side, and cut out the rest to the proper depth, giving the inside of the bottom a circular form, as represented by the annexed figure*:



This trough is to be filled with mercury to the height of a quarter of an inch above the surface of the shelf. A small glass jar is then to be filled with the mercury, and placed on the shelf of the trough over one of the slits made on purpose.

The apparatus being thus disposed, two or three ounces of common salt are to be put into a small retort, and an equal quantity of sulphuric acid added; the beak of the retort plunged below the surface of the mercury in the trough, and the heat of a lamp applied to the bottom of the retort. A violent effervescence will then take place; and air bubbles will rush in great numbers from its beak, and rise to the surface of the mercury in a visible white smoke, which has a very peculiar odor. After allowing a number of them to escape, till it is supposed that the common air which previously existed in the retort has been displaced, plunge its beak into the slit in the shelf over which the glass jar has been placed. The air bubbles will soon displace the mercury and fill the jar. The gas thus obtained is called *muriatic acid gas.*

This substance in a state of solution in water was known even to the alchymists; but in a gaseous state, it was first examined by Dr. Priestley, in an early part of that illustrious career in which he added so much to our knowledge of gaseous bodies.

1. Muriatic acid gas is an invisible elastic fluid, resembling common air in its mechanical properties. Its specific gravity, according to the experiments of Mr. Kirwan, is 1·929, that of air being 1·000, at the temperature of 60°, barometer 30 inches; 100 cubic inches of it weigh 59·8 grains. Its smell is pungent and peculiar; and whenever it comes in contact with common air, it forms with it a visible white smoke. If a little of it be drawn into the mouth, it is found to taste excessively *acid,* much more so than vinegar.

2. Animals are incapable of breathing it; and when plunged into jars filled with it, they die instantaneously in convulsions. Neither will any combustible burn in it. It is remarkable, however, that it has a considerable effect upon the flame of combustible bodies; for if a burning taper be plunged into it, the flame, just before it goes out, may be observed to assume a green color, and the same tinge appears next time the taper is lighted.

3. If a little of the blue colored liquid, which is obtained by boiling red cabbage leaves and water in a tin vessel, be let up into a jar filled with muriatic acid gas, it assumes a fine red color. This change is considered by chemists as a characteristic property of *acids;* but this will be fully treated of afterwards.

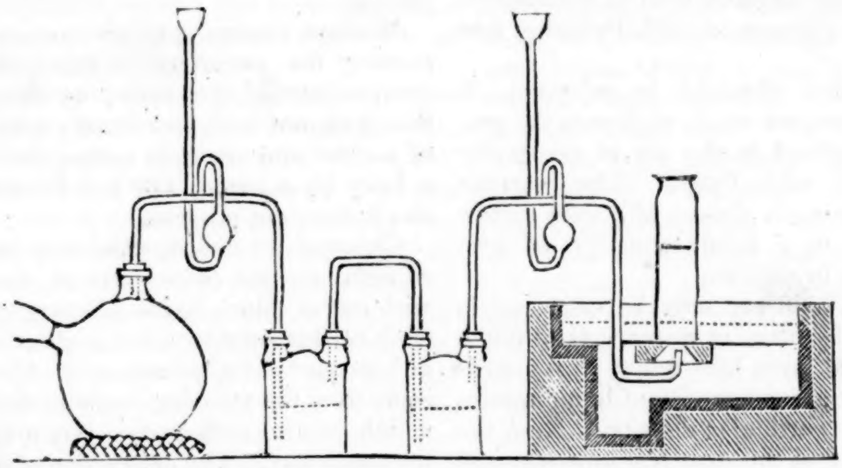
4. If a little water be let up into a jar filled with this gas, the whole gas disappears in an instant, the mercury ascends, fills the jar

* Troughs of this kind are to be got ready made at all the shops where chemical apparatus are sold.

and forces the water to the very top. The reason of this is, that there exists a strong affinity between muriatic acid gas and water; and whenever they come in contact, they combine and form a liquid; or, which is the same thing, the water absorbs the gas. Hence arises the necessity of making experiments with this gas over mercury. In the water cistern not a particle of gas would be procured. The water of the trough would even rush into the retort and fill it completely. It is this affinity between muriatic acid gas and water which occasions the white smoke that appears when the gas is mixed with common air. The solution of muriatic acid gas in water is usually denominated simply *muriatic acid* by chemists.

In this state it appears to have been known to the alchymists; but Glauber was the first who extracted it from common salt by means of sulphuric acid. It is prepared for commercial purposes, by mixing together one part of common salt and seven or eight parts of clay, and distilling the mixture; or by distilling the usual proportion of common salt and sulphuric acid, and receiving the product in a receiver containing water. For chemical purposes it may be procured pure in the following manner:

A hundred parts of dry common salt are put into a glass matrass, to which there is adapted a bent glass tube that passes into a small Wolfe's apparatus, which is represented by the following figure:



The first jar which is immediately connected with the receiver is employed for condensing the vapor that issues from the retort, and the first bottle contains a quantity of water equal in weight to the common salt employed, but part of the water may be put into the second bottle. When the apparatus is properly secured by luting, pour gradually through the bent tube 75 parts of sulphuric acid, or three-fourths the weight of the salt, making the additions at considerable intervals. On each effusion of the acid a large quantity of muriatic gas will pass along the bent tube, and will be absorbed by the water in the first bottle till this has become saturated; it will then pass on to the second bottle, and so on to more, if they are deemed necessary.

The gas that is not absorbed by the water at its exit from the last bottle is conveyed, by means of the recurved tube, into a jar standing in a mercurial trough, as represented in the foregoing figure.

When the whole of the sulphuric acid has been added and the gas no longer issues, heat is then to be applied, which will renew the production of the gas. At this period it will be necessary to keep the luting which connects the retort and receiver perfectly cool, otherwise it will be apt to melt.

When no more gas is produced, the operation may be suspended, and the liquid in the two bottles, which is muriatic acid, put into others with ground stoppers, and preserved for use.

A cubic inch of water, at the temperature of 60°, barometer 29·4°, absorbs 515 inches of muriatic gas, which is equivalent to 308 grains nearly. Hence water thus impregnated contains 0·548, or more than half its weight of muriatic acid, in the same state of purity as when gaseous. Dr. Thomson caused a current of gas to pass through water till it refused to absorb any more. The specific gravity of the acid thus obtained was 1·203. If we suppose that the water in this experiment absorbed as much gas as in the last, it will follow from it, that six parts of water, by being saturated with this gas, expanded so as to occupy very nearly the bulk

of 11 parts; but in all the trials which were made upon it, the expansion was only nine parts. This would indicate a specific gravity of 1·477; yet upon actually trying water thus saturated, its specific gravity was only 1·203. Can this difference be owing to the gas that escapes during the acquisition of the specific gravity?

During the absorption of the gas, the water becomes hot. Ice also absorbs this gas, and is at the same time liquified. The quantity of this gas absorbed by water diminishes as the heat of the water increases, and at a boiling heat water will not absorb any of it. When water impregnated with it is heated, the gas is again expelled unaltered. Hence muriatic acid gas may be procured by heating the common muriatic acid of commerce. It was by this process that Dr. Priestley first obtained it.

The acid thus obtained is colorless: it has a strong pungent smell, similar to the gas, and when exposed to the air is constantly emitting visible white fumes. The muriatic acid of commerce is always of a pale yellow color, owing to a small quantity of iron which it holds in solution.

As muriatic acid can only be used conveniently when dissolved in water, it is of much consequence to know how much pure acid is contained in a given quantity of liquid muriatic acid of any particular density. Now, the specific gravity of the strongest muriatic acid that can easily be procured and preserved, is 1·196: it would be needless, therefore, to examine the purity of any muriatic acid of superior density. Mr. Kirwan calculated that muriatic acid, of the density of 1·196, contains 0·2528 of pure acid.

Muriatic acid was long considered as being capable of combining with oxygen, and forming with it compounds possessed of very different properties from the acid itself. But this theory has lately been abandoned by most of the leading chemists of the day, in consequence of the results of a number of experiments made upon this substance by Sir H. Davy, and subsequently by several other distinguished chemists both in this country and on the continent.

The result of these experiments, and the consequent change which they have produced on the whole science of chemistry, will be particularly noticed in treating of *Chlorine*.*

It may, however, be necessary to state here, that *muriatic acid* is now generally believed to be a *compound* of this substance and *hydrogen*.

* This substance was formerly called oxymuriatic acid; but Sir H. Davy gave it this name in consequence of its green color.

CHLORINE.—The introduction of the term *Chlorine* marks an important era in the science of chemistry. It originated with Sir H. Davy, about the year 1811. At that time he was engaged in making some experiments on oxymuriatic acid gas,* which, after resisting the most powerful means of decomposition which he could employ, he declared to be an elementary body, or simple substance; and not a compound of muriatic acid and oxygen, as was previously imagined, and as its name indicated. He accordingly gave it the name of Chlorine, a term merely descriptive of its color, which is that of a greenish yellow.

Without venturing to give any opinion respecting the propriety of this name, or the composition of the body, we may remark, that it cannot be in conformity with the rules of a strict and accurate nomenclature to call a body by a name, which indicates properties it does not possess.

Chlorine, or chloric gas, may be obtained as follows: mix *three* parts of common salt with *one* of black oxide of manganese. Introduce this mixture into a glass retort, and add *two* parts of sulphuric acid. Gas will then issue from the retort in considerable quantity, which may be collected in jars over water in the usual way. The production of the gas will be favored by the application of a gentle heat. As part of the consistence formed by the ingredients used in this process is apt to boil over into the neck of the retort, a mixture of liquid muriatic acid and manganese is more convenient for producing chlorine. When this process is employed, a very slight degree of heat is sufficient to extricate the gas. The red oxide of lead, or mercury, may be employed instead of manganese.

This gas, as already remarked, is of a greenish yellow color, which is quite perceptible by day-light, but scarcely discernible by candle-light.

Its odor and taste are disagreeable, strong, and so characteristic, that it is impossible to mistake it for any other gas.

When it is breathed, even much diluted with atmospherical air, it occasions a sense of strangulation, constriction of the *thorax*, and a copious discharge from the nostrils. If respired in larger quantity, it excites vio-

* This gas was discovered by Scheele, and called by him dephlogisticated muriatic acid; but was afterwards called oxymuriatic acid, by the French chemists.

lent coughing, with spitting of blood, and would speedily occasion the death of the individual in great distress.

Its specific gravity is 2·473. This is better inferred from the specific gravities of hydrogen and muriatic acid gas, than from its direct weight, on account of the impossibility of confining it over mercury.

One volume or measure of hydrogen, added to one of chlorine, form two of the acid gas. Hence, if from twice the specific gravity of muriatic gas, which is 2·543, we subtract that of hydrogen, which is 0·069, the difference, or 2·474, is the specific gravity of chlorine. At a mean temperature and pressure, 100 cubic inches weigh 75½ grains.

In its perfectly dry state it has no effect on dry vegetable colors; but with the aid of a little moisture, it bleaches or turns them of a yellowish white color.

Scheele, who discovered this gas, was also the first who discovered its bleaching property. Berthollet applied it to the art of bleaching in France, from whom the late Mr. Watt learned the process, while in Paris, and introduced it into this country, where it is now employed to a very great extent in bleaching both linen and cotton. If a lighted taper be immersed rapidly into this gas, it consumes very fast, burning with a dull reddish flame, and giving out much smoke. The taper will not burn at the surface of the gas. Hence, if it be slowly introduced, it is apt to be extinguished.

Potassium, sodium, copper, tin, arsenic, zinc, antimony, and several other metals, take fire and burn spontaneously in this gas, if introduced in fine laminæ, or filings.

Phosphorus also takes fire at ordinary temperatures.

The result of the combustion of any substance in chlorine is termed a chloride, as chloride of zinc, chloride of phosphorus, &c. Sulphur may be melted in chlorine without taking fire, and in this state it forms a liquid chloride of a reddish color. When dry, it is not altered by any change of temperature; but when inclosed in a vial with a little moisture, it concretes into chrystalline needles, at 40° of Fahrenheit's scale.

According to M. Thenard, water condenses 1½ times its bulk of chlorine, at the temperature of 68° F. and 29·92 barom., and forms aqueous chlorine, or what was formerly called liquid oxymuriatic acid. This combination is best effected in the second bottle of a Wolfe's apparatus: see the figure in page 199, the first bottle being charged with a little water to intercept the muriatic acid gas, while the third bottle may contain a solution of potash in water or milk of lime, to condense the superfluous gas. M. Thenard says that a kilogramme, or about 2⅓ pounds avoirdupoise of salt, is sufficient to saturate 10 litres, or about 21 English pints of water. Mr. Tennent, of Glasgow, has superceded the necessity of saturating water with this gas for the purpose of bleaching, by substituting slacked lime for water.

This liquid chloride of lime congeals at a temperature of 40° of Fahrenheit, and affords crystallized plates of a deep yellow color, containing a less portion of water than the liquid combination. Hence, when chlorine is passed into water at a temperature under 40°, the liquid finally becomes a concrete mass, which a gentle heat liquifies with effervescence from the escape of the excess of chlorine.

It is in the liquid state that it is employed in bleaching, and when used in this way it is always decomposed: for the liquid, after it has been employed in bleaching, will be found to have lost its smell, and to precipitate nitrate of mercury, which it will not do before, if it be pure. In fact, this is the best test for determining whether it be pure or not. It often contains a portion of muriatic acid, and when this is the case, it has the effect of precipitating mercury from its solution in nitric acid, which it does not do when perfectly free from muriatic acid.

The watery solution is also decomposed when exposed to the direct rays of the sun; therefore, when it is intended for bleaching, it ought to be kept from the direct rays of the sun.

It has already been remarked, that slacked lime, saturated with chlorine, has been employed in bleaching as well as the watery solution of it; but we ought to add, that it is found to answer better for this purpose than the watery solution, and is less dangerous, both to the goods and the constitutions of those who are employed in using it for this purpose.

When the gas is passed into a trough containing slacked calcined lime in the state of a paste, it combines with the lime and converts it into a dry powder, which, when mixed with water, has also the power of discharging color, and is therefore now much employed in the bleaching of goods. Magnesia is also employed in the same way in bleaching the finer kinds of muslin.

When steam and chlorine are passed together through a red hot porcelain tube, they are converted into muriatic acid and oxygen. Aqueous chlorine attacks almost all the metals at an ordinary temperature, forming muriates or chlorides, and heat is evolved. It has the smell, taste, and color of chlorine; its taste is somewhat astringent, but not in the least degree acidulous.

When we put in a perfectly dark place, at the ordinary temperature, a mixture of chlorine and hydrogen, it experiences no kind of alteration, even in the space of a great many days. But if, at the same low temperature, we expose the mixture to the diffuse light of day, by degrees the two gases enter into chemical combination, and form muriatic acid gas. There is no change in the *volume* of the mixture, but the change of its *nature* may be proved by its rapid absorption by water, its not exploding by the lighted taper, and the disappearance of the chlorine hue. To produce the complete discoloration, we must expose the mixture finally for a few minutes to the sun-beam. If exposed at first to this intensity of light, it explodes with great violence, and instantly forms muriatic acid gas. The same explosive combination is produced by the electric spark and the lighted taper. M. Thenard says, a heat of 392° is sufficient to cause the explosion. The proper proportion is an equal volume of each gas. Chlorine and nitrogen combine into a remarkable detonating compound, by exposing the former gas to a solution of an ammoniacal salt. (See Nitrogen.)

Chlorine is now much employed in purifying places of noxious vapors, as it soon neutralizes every species of noxious effluvia. It is also said to have the effect of recovering putrid animal matter.

If diluted muriatic acid be added to chlorate of potash, (potash combined with chlorine,) another gas will be produced.

It is of a deeper yellow color than chlorine, and has also the effect of discharging vegetable colors; but it first gives blue colors a tint of red. When a vessel of this gas is exposed to a moderate heat, it explodes and is decomposed into a mixture of chlorine and oxygen gas.

This gas was discovered by Sir H. Davy, in 1811, and called by him *Euchlorine*.

It has the effect of inflaming sulpluric ether, alcohol, and oil of turpentine, when poured into it.

As we have now described the chief properties of chlorine, and mentioned some of the uses to which it is now successively applied in the arts, it may not be improper to add a short account of the experiments made upon it by Sir H. Davy, and the reasoning he has employed to prove that it is a simple or elementary body.

He subjected oxymuriatic gas to the action of many simple combustibles, as well as metals, and from the compounds formed endeavored to eliminate oxygen, by the most energetic powers of affinity and voltaic electricity, but without success, as the following abstract will show:

He admitted the ammoniacal gas over mercury to a small quantity of the liquid of Libavius; it was absorbed with great heat, and no gas was generated; a solid result was obtained, which was of a dull white color; some of it was heated, to ascertain if it contained oxide of tin, but the whole volatilized, producing dense pungent fumes.

Another experiment of the same kind, made with great care, and in which the ammonia was used in great excess, proved that the liquor of Libavius cannot be decompounded by ammonia, but that it forms a new combination with this substance.

He made a considerable quantity of the solid compound of oxymuriatic acid and phosphorus by combustion, and saturated it with ammonia, by heating it in a proper receiver fitted with ammoniacal gas, on which it acted with great energy, producing much heat, and they formed a white opaque powder. Supposing that this substance was composed of the dry muriates and phosphates of ammonia, as muriate of ammonia is very volatile, and as ammonia is driven off from phosphoric acid by a heat below redness, he conceived that by igniting the product obtained he should procure phosphoric acid; he therefore introduced some of the powder into a tube of green glass, and heated it to redness, out of the contact of air, by a spirit lamp; but found, to his great surprize, that it was not at all volatile nor decomposable at this degree of heat, and that it gave off no gaseous matter.

The circumstance, that a substance composed principally of oxymuriatic acid and ammonia should resist decomposition, or change at so high a temperature, induced him to pay particular attention to the properties of this new body.

He mixed together sulphuretted hydrogen in a high degree of purity, and oxymuriatic acid gas, both dried in equal volumes. In

this instance the condensation was not $\frac{1}{10}$; sulphur, which seemed to contain a little oxymuriatic acid, was formed on the sides of the vessel; no vapor was deposited; and the residual gas contained about $\frac{19}{20}$ of muriatic acid gas, and the remainder was inflammable.

He caused strong explosions from an electrical jar to pass through oxymuriatic gas, by means of points of platina, for several hours in succession; but it seemed not to undergo the slightest change.

He electrized the oxymuriates of phosphorus and sulphur for some hours, by the power of the voltaic apparatus of 1000 double plates. No gas separated, but a minute quantity of hydrogen, which he was inclined to attribute to the presence of moisture in the apparatus employed; for he once obtained hydrogen from Libavius's liquor by a similar operation. But he ascertained that this was owing to the decomposition of water adhering to the mercury; and in some late experiments made with 2000 double plates, in which the discharge was from platina wires, and in which the mercury used for confining the liquor was carefully boiled, there was no production of any permanent elastic matter.

Iodine.—Iodine was accidentally discovered in 1812, by M. de Courtois, a manufacturer of saltpetre at Paris. In his processes for procuring soda from the ashes of sea weeds, he found the metallic vessels much corroded; and in searching for the cause of the corrosion, he made this important discovery. But for this circumstance, merely accidental, one of the most curious of substances might have remained for ages unknown, since Nature has not distributed it, in either a *simple* or *compound* state, through her different kingdoms, but has confined it to what the Roman satirist considers as the most worthless of things, the *vile sea weed.*

Iodine derived its first illustration from MM. Clement and Desormes. In their memoir, read at a meeting of the Institute of France, these able chemists described its principal properties. They stated its specific gravity to be about 4; that it becomes a *violet colored gas* at a temperature below that of boiling water, whence it received the name of *Iodine,* which is a word derived from the Greek, signifying, *like a violet;* that it combines with the metals, and with phosphorus, and sulphur, and likewise with the alkalis and metallic oxides; that it forms a detonating compound with ammonia; that it is soluble in alcohol, and still more soluble in ether; and that by its action upon phosphorus and upon hydrogen, a substance is formed, having the characters of muriatic acid. In this communication they offered no decided opinion respecting its nature.

In 1813 Sir H. Davy happened to be on a visit to Paris, and when M. Clement showed him Iodine, he said he believed it was a substance analogous in its chemical relations to chlorine.

Iodine has been found in various kinds of sea weed. But it is from the incinerated sea weed or kelp, that Iodine is to be obtained in quantities. Dr. Wollaston first communicated a precise formula for extracting it, which is as follows: Dissolve the soluble part of kelp in water; concentrate the liquid by evaporation, and separate all the crystals that can be obtained. Pour the remaining liquid into a clean vessel, and mix with it an excess of sulphuric acid. Boil this liquid for some time. Sulphur is precipitated, and muriatic acid driven off. Decant off the clear liquid, and strain it through wool. Put it into a small flask, and mix it with as much black oxide of manganese as was used before of sulphuric acid. Apply to the top of the flask a glass tube, shut at one end. Then heat the mixture in the flask. The Iodine sublimes into the glass tube.

None can be obtained from sea water.

In repeating this process, Dr. Ure, of Glasgow, obtained from similar quantities of kelp such variable products of Iodine, that he was induced to institute a series of experiments for discovering the causes of these anomalies, and for procuring Iodine at an easier rate. In this he appears to have been successful, for instead of procuring this singular element in such small quantity as a few grains, he has obtained ounces at a time, and at a moderate expense. But our limits will not permit us to give a detail of the process he pursued.*

The substance he obtained it from was the residuum of soap leys, the alkaline matter of which consisted solely of kelp. From this residuum he first obtained a brown oily liquid, and from this liquid he procured Iodine in considerable quantity.

Iodine is a solid, of a grayish-black color and metallic lustre. It is often in scales similar to those of micaceous iron ore, sometimes in rhomboidal plates, very large and

* This will be found in the 50th volume of the Philosophical Magazine.

very brilliant. It has been obtained in elongated octahedrons, nearly half an inch in length; the axis of which were shown by Dr. Wollaston to be to each other as the numbers 2, 3, and 4,—at least so nearly, that in a body so volatile, it is scarcely possible to detail an error in this estimate, by the reflective goniometer. Its fracture is lamellated, and it is soft and friable to the touch. Its taste is very acrid, though it is very sparingly soluble in water. It is a deadly poison. It gives a deep brown stain to the skin, which soon vanishes by evaporation. In odor, and power of destroying vegetable colors, it resembles very dilute aqueous chlorine. The specific gravity of Iodine at $62\frac{1}{2}°$ is 4·948. It dissolves in 7000 parts of water. The solution is of an orange yellow color, and in small quantity tinges raw starch of a purple hue, which vanishes on heating it. It melts, according to M. Gay Lussac, at 227° F., and is volatilized under the common pressure of the atmosphere, at the temperature of 350°. According to Ure, it evaporates pretty quickly at ordinary temperatures. Boiling water aids its sublimation, as is shown in the above process of extraction. The specific gravity of its violet vapor is ·8678. It is a non-conductor of electricity. When the voltaic chain is interrupted by a small fragment of it, the decomposition of water instantly ceases.

Iodine is incombustible, but with azote it forms a curious detonating compound; and in combining with several bodies, the intensity of their mutual action is such as to produce the phenomena of combustion.

Iodine combines with oxygen and with chlorine; but these combinations will be described when treating of iodic acid.

With a view of determining whether it was a simple or compound form of matter, Sir H. Davy exposed it to the action of the highly inflammable metals. When its vapor is passed over potassium heated in a glass tube, inflammation takes place, and the potassium burns slowly with a pale blue light. There was no gas disengaged when the experiment was repeated in a mercurial apparatus. The iodide of potassium is white, fusible at a red-heat, and soluble in water. It has a peculiar acrid taste.* When acted on by sulphuric acid, it effervesces, and Iodine appears. It is evident that in this experiment there had been no decomposition; the result depending merely on the combination of Iodine with potassium. By passing the vapor of Iodine over dry red hot potash, formed from potassium, oxygen is expelled, and the above iodide results. Hence we see, that, at the temperature of ignition, the affinity between Iodine and potassium is superior to that of the latter for oxygen. But Iodine in its turn is displaced by chlorine, at a moderate heat; and if the latter be in excess, chloriodic acid is formed. M. Gay Lussac passed vapor of Iodine in a red heat over melted sub-carbonate of potash, and he obtained carbonic acid and oxygen gases, in the proportions of two in volume of the first, and one of the second, precisely those which exist in the salt.

The oxide of sodium, and the sub-carbonate of soda, are completely decomposed by Iodine. From these experiments, it would seem that this substance ought to disengage oxygen from most of the oxides; but this happens only in a small number of cases. The protoxides of lead and bismuth are the only oxides not reducible by mere heat, with which it exhibited that power.* Barytes, strontian, and lime, combine with Iodine, without giving out oxygen gas, and the oxides of zinc and iron undergo no alteration in this respect. From these facts, we must conclude that the decomposition of the oxides by Iodine depends less on the condensed state of the oxygen, than upon the affinity of the metal for Iodine. Except barytes, strontian, and lime, no oxide can remain in combination with Iodine at a red heat.

M. Gay Lussac says, "Sulphate of potash was not altered by Iodine; but what may appear astonishing, I obtained oxygen with the fluate of potash, and the glass tube in which the operation was conducted was corroded. On examining the circumstances of the experiment, I ascertained that the fluate became alkaline when melted in a platinum crucible. This happened to the fluate over which I passed Iodine. It appears, then, that the Iodine acts upon the alkali, and decomposes it. The heat produced disengages a new portion of fluoric acid or its radical, which corrodes the glass; and thus by degrees the fluate is entirely decomposed." These facts seem to give countenance to the opinion, that the fluoric is an oxygenized acid; and that the salt called fluate of potash is not a fluoride of potassium.

* When Iodine is combined with any other substance, the compound is called an *iodide* of that substance.

* A protoxide signifies a substance combined with one, or the first, dose of oxygen.

Iodine forms with sulphur a feeble compound of a grayish-black color, radiated like sulphuret of antimony. When it is distilled with water, Iodine separates.

Iodine and phosphorus combine with great rapidity at common temperatures, producing heat without light. From the presence of a little moisture, small quantities of hydriodic acid gas are exhaled.

Oxygen expels Iodine from both sulphur and phosphorus. "Hydrogen," says Gay Lussac, "whether dry or moist, did not seem to have any action on Iodine at the ordinary temperature of the atmosphere; but if, as was done by Clement, in an experiment in which I was present, we expose a mixture of hydrogen and Iodine to a red heat in a tube, they unite together, and hydriodic acid is produced, which gives a reddish-brown color to water." Sir H. Davy, with his characteristic ingenuity, threw the violet colored gas upon the flame of hydrogen, when it seemed to support its combustion. He also formed a compound of Iodine with hydrogen, by heating to redness the two bodies in a glass tube.

Charcoal has no action upon Iodine, either at a high or low temperature. Several of the common metals, on the contrary, as zinc, iron, tin, mercury, attack it readily, even at a low temperature, provided they be in a divided state. Though these combinations take place rapidly, they produce but little heat, and but rarely any light.

When Iodine and oxides act upon each other in contact with water, the water is decomposed; its hydrogen unites with Iodine, to form hydriodic acid; while its oxygen, on the other hand, produces, with Iodine, iodic acid. All the oxides, however, do not give the same results. We obtain them only with potash, soda, barytes, strontian, lime, and magnesia.

From all the above recited facts, we are warranted in concluding Iodine to be *an undecompounded body*. In its specific gravity, lustre, and magnitude, it resembles the metals; but in all its chemical agencies, it is analogous to oxygen and chlorine. It is a non-conductor of electricity, and possesses, like these two bodies, the negative electrical energy with regard to metals, inflammable, and alkaline substances; and hence, when combined with these substances in aqueous solution, and electrized in the voltaic circuit, it separates at the positive surface. But it has a positive energy with respect to chlorine; for when united to chlorine, in the chloriodic acid, it separates at the negative surface. This likewise corresponds with their relative attractive energy, since chlorine expels Iodine from all its combinations. Iodine dissolves in carburet of sulphur, giving, in very minute quantities, a fine amethystine tint to the liquid.

Iodide of mercury has been proposed for a pigment;* in other respects, Iodine has not been applied to any purpose of common life. M. Orfila swallowed six grains of Iodine, and was immediately affected with heat, constriction of the throat, nausea, eructation, salivation, and cardialgia. In ten minutes he had copious bilious vomitings, and slight colic pains. His pulse rose from 70 to about 90 beats in the minute. By swallowing large quantities of mucilage, and emollient clysters, he recovered, and felt nothing next day but a slight fatigue. About 70 or 80 grains proved a fatal dose to dogs. They usually died on the fourth or fifth day.

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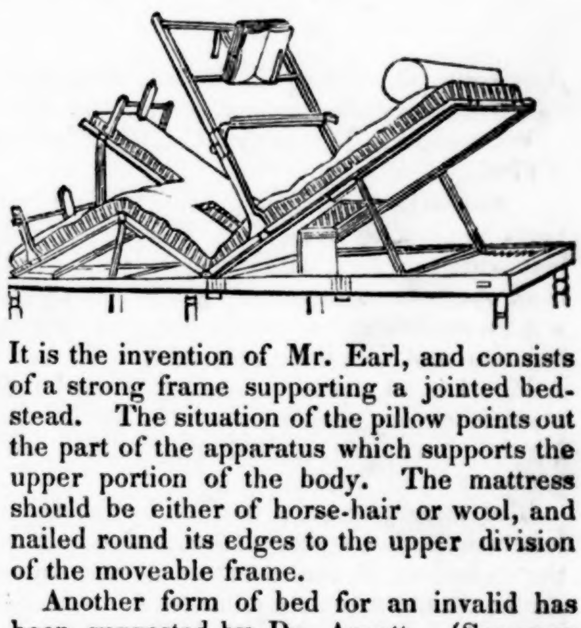
Invalid Bed.—There are many contrivances under this name, but the one represented beneath seems the best mechanical arrangement for the purpose.



It is the invention of Mr. Earl, and consists of a strong frame supporting a jointed bedstead. The situation of the pillow points out the part of the apparatus which supports the upper portion of the body. The mattress should be either of horse-hair or wool, and nailed round its edges to the upper division of the moveable frame.

Another form of bed for an invalid has been suggested by Dr. Arnott. (See page 37, Vol. II.) It consists of a trough containing water, and covered with a cloth composed of cotton coated with Indian rubber. This forms one of the softest and most flexible beds that has ever been devised.—[Partington.]

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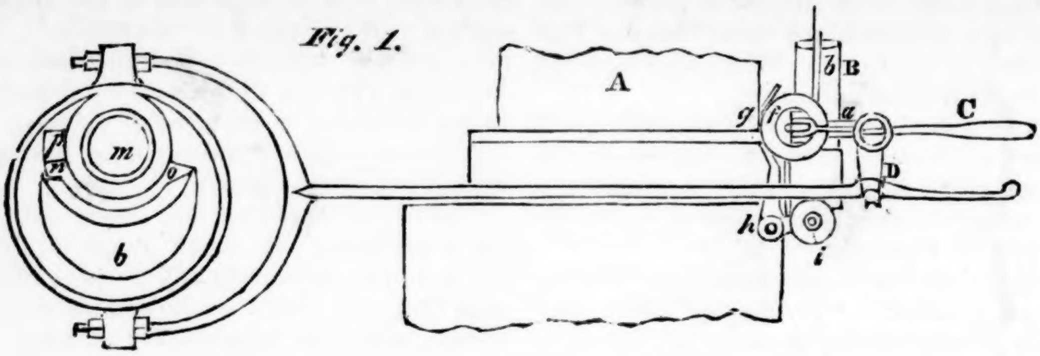
* There are two iodides of mercury, the one yellow and the other red; both are fusible and volatile.

*Fig. 1.*



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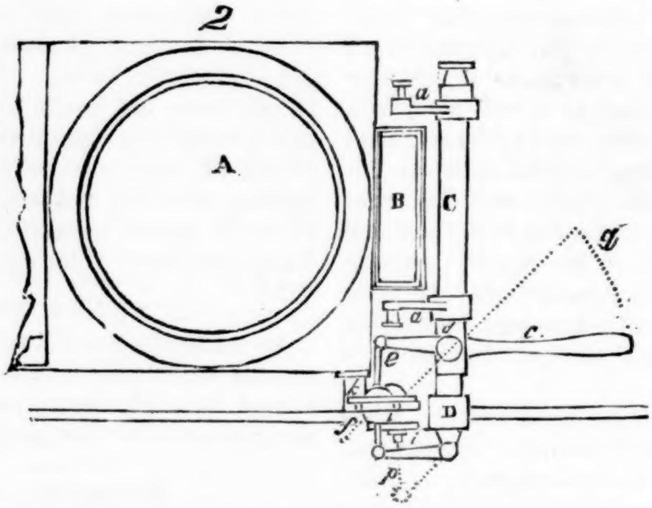


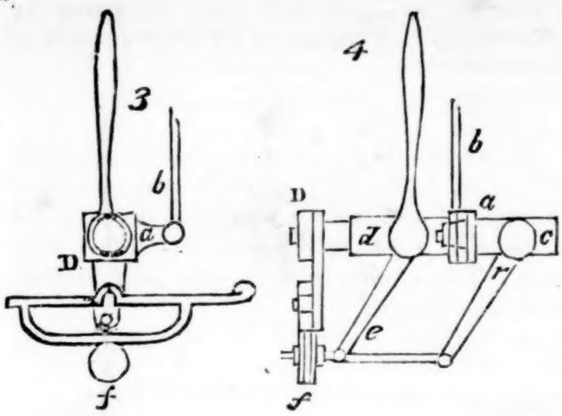
***Apparatus for Setting in Motion, Stopping, or Reversing the Steam Engine.*** By Jas. Whitelow. [From the London Mechanics' Magazine.]

Sir,—To be able to set on, stop, or reverse the motion in coal pit, steamboat, and locomotive engines, without shifting the hand from one lever to another, enables the person in attendance to effect his purposes in *less time* and with more certainty.

Fig. 1 is an elevation, and fig. 2 a ground plan, of a very simple apparatus for effecting the above ends, applied to a common low pressure steam engine.

The same parts are marked by the same letters in both the plan and elevation. A is the cylinder; B, the nozzles; C, the wiper shaft; D, the wiper; *a a*, levers for working side rods, *b*, running along side the nozzles to the cross head, or top of valve rod. The starting bar, *c*, works on a centre, *d*, in the wiper shaft, and is produced beyond it until it meets the rod *e*, on which the pulley, *f*, is at liberty to revolve or work lengthwise, to allow the bell crank lever, *g h i*, always to rest in its groove. The lever, *g h i*, turns on a pin or stock fixed in the side of the cistern; the end, *g*, of this lever is a circle drawn from the centre of the wiper shaft, so that the lever will not move when the valve is wrought by hand; the pulley, *i*, turns on the other end, and lifts or lowers into gear the eccentric rod, by a simple motion of the starting bar sidewise. The eccentric, *b*, is at liberty to make half a revolution on the cranking shaft, *m*, but is prevented from turning more, by catches, *n o*, fixed on the shaft which works against the mug, *p*, cast on the eccentric, so that, in whichever way the engine turns, one or other of the catches on the crank shaft will work the eccentric so as to open and shut the valves at the proper time for the engines working in that direction. When the starting bar is in the position shown in the above sketch, the engine keeper can work the valve so as to start the engine in any direction, or stop it at any part of the stroke he pleases. After the engine is started in the direction wanted, the motion is continued in that direction by simply pushing the starting box into the position of the dotted line, *d g*, when the rod, *e*, and lever, *r*, will take the place of the other dotted lines, and allow the eccentric rod to fall into gear.

Fig. 3 is a side, and fig. 4 an end elevation




of this apparatus, where the starting bar works in a vertical direction, and is so simple as to need no description. The same letters point out the same parts in figures 1 and 2. Your obedient servant,

James Whitelow.

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Application of Steam.—An advertiser in the Louisville Advertiser, signed A. B. C., thus announces his pretensions: "After a most persevering study in chemistry for 25 years, and mechanical philosophy, I have arrived at the conclusion, that Captain Savary Fitch, Oliver Evans, Watts and Bolton, Ericsson, Braithwaite, Stevenson, of Manchester, Robert L. Stevens, of New-York, and all the other engineers of science, theory, and practice, with Perkins, of London, and Dupin, have been entirely *on the wrong scent or pursuit for power*. Therefore, I deem it essential to say, I have found the *fulcrum of Archimedes* brought by Thales to me—I shall move a common steamboat at a velocity of 15 miles per hour, on rivers—*I will move a* 60 *gun battery of* 42 *pounders*, in 12 feet water, at 12 miles per hour, for national defence, without the possibility of the enemy injuring the vessel or machine—*I will cross the Atlantic in ten days* in a Power Packet, *without stopping for fuel*—I will ascend the river Mississippi at an average speed of 13½ miles per hour; and if only a passage boat, I will navigate the Ohio and Mississippi, without freight, at 18 miles per hour. I will contract to complete and perfect the improvement in any small boat, or large size boat, in two or three months. I am prepared to give satisfactory security and sufficient guarantees to perform whatever contract I make immediately, without defalcation. ☞ Reference to the Editor of the Advertiser.

[We presume the respectable editor of the Advertiser is satisfied that these assertions are correct, or he would not allow his name to be used. We must confess that we are somewhat incredulous about them, and should be much gratified to be able to lay before our readers something more substantial than the mere assertions of an anonymous advertiser.—Ed. Mech. Mag.]

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*Mr. Hancock's Steam Omnibus.* [From the London Mechanics' Magazine.]

Sir,—More than six years have elapsed since I began my experiments on steam locomotion; and I have followed it with an ardor that did not admit of any diversion from the grand object which I kept steadily in view. During the past week I have exhibited daily on the Paddington road a steam omnibus, the result of my experience; and having hitherto carefully steered clear both of extravagant anticipations and exaggerated statements, I should be sorry if any such should find their way into the public prints. In order to prevent this, as far as I am able, I beg to hand you for insertion, in your wide spreading miscellany, the following results of the first six days:

April 22—Started from Cottage lane, City road, to Paddington, and from Paddington to London wall, and back to Cottage lane—9½ to 10 miles—1 hour 8 minutes. Delays, 18 minutes—travelling, 50 minutes.

April 23—From Cottage lane to Paddington, and back to Cottage lane—8½ miles—1 hour 11 minutes. Delays, 9 minutes—travelling, 62 minutes.

April 24—Same ground—1 hour 4 minutes. Delays, 11½ minutes—travelling, 53 minutes.

April 25—Same ground, and back as far as St. James' Chapel—piston broke.

April 26—Same ground, and back to Cottage lane—49 minutes. Delays, 5 minutes—travelling, 44 minutes.

April 27—Same ground—50 minutes. Delays, 5½ minutes—travelling, 44½ minutes.

Average quantity of coke, 1 sack to each trip.

It is not intended to run this carriage more than about a week longer; partly because it was only intended as a demonstration of its efficiency, and partly because my own occupations will not admit of my personal attention to the steering, which I have hitherto performed myself, having no other person at present to whose guidance I could with propriety entrust it. During the time that it will require to build two more carriages for the Paddington Company, I shall have one or two others of my own running, which will afford me an opportunity for training steersmen, &c. for this road, which, of all others I am acquainted with, requires the greatest steadiness and attention.

I am, sir, your obedient servant,

W. Hancock.

Stratford, May 1, 1833.

N. B.—I would just observe, that your cor-

respondent "Candidus" has, I think, stated the number of journeys rather too high. From the manner, also, of wording his letter, it would almost seem to imply that the "Enterprize" was built in the City road, and that other carriages were in progress of building there; but I have no establishment in London, and the "Enterprize" was built at my own place at Stratford, and had its first trials on that road. I took it to town merely to avail myself of the assistance of London artists in its decoration, &c.; after which, and before its delivery, I ran it over its intended road, &c. as stated by "Candidus." Thus much for steering clear of all mistakes.

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To revive Gilt Frames.—Beat up three ounces of white of eggs with one ounce of chloride of potassa or soda, and do over the frame with a soft brush dipped in this mixture. The gilding will become immediately fresh and bright.

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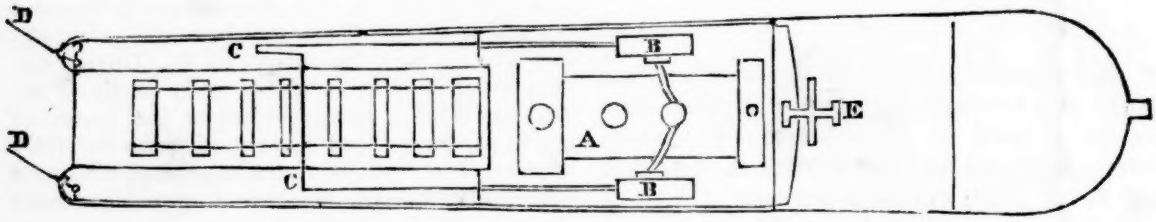


*Steamboats with Paddles in the Stern.* By J. F. B. [From the London Mechanics' Magazine.]

Sir,—There is a small boat now fitting up in this port which is intended for the use of our Belgian neighbors; and as it is entirely different in construction from any I have yet seen, be kind enough to insert the following description of it in your useful Magazine. Your obedient servant,

J. F. B.

Liverpool, June 4, 1833.

A is the boiler, on Messrs. Stephensons' principle, with tubes running through the length of it. It is a high pressure one, and of precisely the same construction as those of the railway locomotives. B B, two ten boxes cylinders, working by means of cranks. C C, the paddle-wheel, placed in the stern of the vessel.

The vessel is made of iron, except the upper works above water mark; is 76 feet long, 14 feet 10 inches broad, and draws about 2 feet 4 inches water. She is steered by two rudders, D D, on each side of the cavity for the reception of the paddle-wheel; and the steering wheel is at E, in the centre of the vessel, before the engine house.

In a late trial she went 7 miles in 33 minutes, tide in favor. The steam was not up at its full height, nor were the paddle-boards deep enough.

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Undulating Railways.—The great excitement that has been caused in Europe by the controversy on this subject, in all the scientific journals, and more especially since Mr. Badnall has put forth his plan, has determined us to insert in our columns the whole of the correspondence that has appeared in print. It will be found exceedingly interesting to many of our readers. If any of our correspondents will favor us with their opinions on the subject, we shall be glad: it will materially assist us in elucidating the truth.—[Ed. M. M.]

*The Undulating Railway.* By Junius Redivivus. [From the London Mechanics' Magazine for March.]

Sir,—I have been casually informed that there is exhibiting somewhere about town, a model of an undulating railway, whereby the inventor undertakes to convince the public that the antique notion of level surfaces being the best adapted for wheel carriages is entirely wrong; and, of course, if his position be correct, the road surveyors have wasted a 'pretty considerable quantity of money,' to make roads worse than they were before, by levelling the hills, which ought to be restored without delay.

But the inventor of the undulating railway is by no means an originator. The Russian ice-hills on the Neva, for the amusement of the sleighers in the winter season, formed of boarded scaffolds, overlaid with blocks of ice, are much more ancient, and the *Montagnes Russes* of the *Champs Elysees*, which served for summer amusement to the youths and maidens at Paris, (the King of Prussia inclusive,) some fifteen years back, were railroads of something of the same nature as that now proposed. But the proposer of the present undulating railway

has stumbled upon a fallacy, which possibly may deceive himself, but which ought not to be suffered to deceive the 'barren spectators' amongst the public, because all such fallacies serve to inflict mischief upon the really useful inventors, by getting them classed under the invidious name of 'schemers,' which ought properly to be confined to the plotters of absurdities alone.

There can be no doubt that a carriage placed on the top of a hill of sufficient inclination will descend with so much momentum as to drive it partly up a second hill of the same height and inclination, or over a hill of considerably less height and inclination.

There can be no doubt, also, that a fly-wheel, put in motion, will continue to revolve for some time after the original moving power ceases to act on it; but it is a woeful error to suppose that either the fly-wheel or the carriage can generate additional power of their own. I once heard a story of an Irish schemer, who had devised a plan for increasing the power of a ten-horse engine to that of fifty, by means of an enormous fly-wheel. Finding a 'flat,' he was set to work; and when he had, after some difficulty, succeeded in casting his enormous wheel, he expended much money in fitting up an apparatus to turn and polish it all over, to prevent the loss of power by friction in the atmosphere with a rough surface! Much time being lost, the proprietor, who was at all the expense, became impatient, and then there was another delay to know how the wheel was to be stopped, with all its giant power. This having been arranged, both schemer and proprietor were much astonished to find that it would not go at all. The proposition to get additional power, or save power, by means of an undulating surface, savors much of a perpetual motion scheme. It is clear that what is called *momentum* in falling bodies, can be nothing more than *gravitation*, whereby all bodies have a tendency to get as near as they can to the centre of the earth, and the heaviest have the most success. The momentum of the carriage in going down hill is in proportion to the height which it is raised, and the diminishing of friction by the degree of inclination. In the Russian ice hills, the first, from which the sleigh starts, is of a given height; the second diminishes; the third also; and so on until the level ice is attained. Were all the hills of the same height, the sleigh would descend the first, partly ascend the second, and then oscillate for a time between both until it stopped. The reason that the sleigh moves at all, that it possesses the power of motion, is, that it is removed from a lower to a higher level, and the tendency of its gravitating power is to reach the lowest—as the case with water, which has the advantage of being of a more mobile substance. But what places the sleigh in the situation to use this power, or rather what confers the power upon it? The animal power, either of human hands or horses' shoulders, which has been communicated to it, and which, doubtless, if means were taken to ascertain it, would be found to be exactly equivalent to the power put forth in surmounting the hills, with the exception of the loss by friction, *i. e.* the animal power applied in the first instance would have served to draw the sleigh on level ground as great a distance—I mean, over as many yards of surface—as it traversed on the hills. Therefore, in this case, there would be no *gain* of power, or of any thing but amusement.

The late Mr. Bentham was accustomed to say, in a jocular manner, that when he made a world, it should be all down hill. Now, such a contrivance would be admirable for diminishing friction, if there were any arrangement whereby we might always be at the top. If the new invented railway were contrived so that it might be constantly down hill, or over diminishing hills, there is no doubt that much friction might be avoided; but by what process are we to get to the top to begin again? There is but one answer—by labor got out of animals, or steam. And what would be the increase of work up hill? What was gained one way would be lost by the other. I say nothing of the mischief resulting both to cattle and engines by the irregular motion. But we will suppose the railway an average level, *i. e.* the undulations to be all alike, what possible advantages can it have over a straight and regular surface? It has been shown that to get the momentum of the high level, the power must be, so to speak, 'put into it,' *i. e.* it must be applied before hand, just as the steam of an engine is got 'up' to start with effect, or as is said of a horse who has been off work a few days, 'his go is bottled up.' When the carriage on the undulating railway has reached as far up the second ascent as the momentum

will drive it, how much power must be put on to carry it up the remainder of the ascent? Probably as much as it would have taken to perform the distance of two undulations on a level road.

The *Montagnes Russes* of Paris were formed in a circle, and consisted of one descent and one ascent. The descent was steeper than the ascent, yet the impetus, or momentum, only served to carry the car one third up the ascent, when it was hooked by an endless band, worked by horse power below, and drawn to the top. Now, the power applied by the horses in drawing that car to the top was probably equivalent to the power which would have been exerted in drawing the car the whole distance on level ground, difference of friction excepted. The fact is, that in all cases the same quantity of power must be consumed to drag a wheel carriage up to a given height. If the ascent be steep, a large amount of power is requisite for a short time. If the ascent be gradual, a small amount of power will be requisite for a longer time. The total will be equal. Increase of speed is loss of power, and *vice versa*; yet, strange to say, there are numerous unthinking people who believe that by making a simple machine complicated, as in the case of this railroad, they actually multiply their power: as if an accelerated motion down hill were not balanced by an up hill to ascend in turn.

The process is somewhat similar to that of a man who, determining to erect a water-mill, were first to erect a wind-mill or steam engine to pump up the water necessary for his water-wheel. There are, I believe, water-mills in some of the mining districts which are supplied from the pumps worked by engines, but then the power of the engines is not expended for the purpose of getting rid of a stream of water. The power got out of the water afterwards was first put into it by the engines, and the saving that power by using it for the water-mill, is analogous to the process of the soap-makers, who boil down their waste ley to recover the alkali it may contain; but they do not make waste ley for the purpose of getting the alkali out of it. The power of the water-mill is commonly but a very small proportion of that of the engines which supply it, because the descent of the fluid is much less than its ascent. Were it to fall on the wheel from a height equal to that from which it was pumped up, the power of the engine and the power of the water-wheel would be nearly equal, the friction of the pump being taken into account.

Whatever the proprietor of the undulating railway may think, 'power' cannot be self-generated. A man who is in a valley cannot get up into a mountain without labor of some kind; and whether the ascent to the mountain be a straight inclined plane, or a number of undulations, will matter very little; but what difference of labor there is will be in favor of the former. When the boy makes his marble bound on the pavement, there is no saving of labor to him, because it happens to bound three times with one exertion of his muscles. He is obliged to exert so much the more power. The proposition to gain power by making a carriage go up hill and down hill, instead of on a level, reminds me of a scheme I once saw of a self-moving carriage, which was to go on as soon as it was loaded; and the greater the load the faster it was to travel. The ingenious inventor had heard talk of a wheel within a wheel, and he literally put it into practice—small wheels being contrived to run on a rail within a periphery of large ones, both before and behind a four-wheeled vehicle, and so fixed, by means of guides, that the weight was pressing on the rim of the large wheels, at a considerable height above the ground, in expectation of making them revolve. The inventor had entirely forgotten that while the large wheel was pressed down hill, the small one had to travel up hill, and consequently that it was 'no go.' Perfectly similar is the undulating railway. If the eight-wheeled vehicle could have moved at all, it might have been running even unto this day; and if up hill and down hill *versus* level were a clear gain, it might be improved on till animal and machine power might be dispensed with, and the railway locomotive power of every man might reside in his own fingers. We have not come to that yet. We may exert a great quantity of power in various ways, it is true, but no more power can come out of a thing than we put into it. If we wind up a jack, or a clock, or a watch, the amount of power which have been rapidly given is slowly expended—that is the whole process; but a man would be laughed at who were to assert that the power we had given to the machines increased in quantity while in their progression; and thus should the man be laughed at

who asserts that the power of a horse or machine is multiplied by going up and down hill.

Since writing the above I have caused inquiries to be made at the place of exhibition, and am informed that the inventor has gone to Birmingham, I think, for the purpose of setting his scheme going on an undulating railway of three miles in length, to try it on a large scale. I am, sir, yours, &c.,

JUNIUS REDIVIVUS.

*The Undulating Railway.* By J. W. N. BADNALL. [From the London Mechanics' Magazine for April.]

SIR,—I should not have considered it worth my while to have noticed the letter contained in your last number on the subject of '*the undulating railway*,' and signed 'Junius Redivivus,' had it not been accompanied by some remarks of your own, which I feel it necessary to reply to.

As an occasional contributor to your publication, and as a constant reader of it from its commencement, I feel little doubt of your doing me the justice to publish this letter with as little delay as possible.

I am the inventor and patentee of the undulating railway, models of which have recently been exhibited at Manchester and in London, and (however extraordinary it may appear to your correspondent) have engaged the anxious attention and investigation of some of the most scientific men in this kingdom; men who, instead of adopting the ungracious and undigested conclusions of 'Junius Redivivus,' have not considered it a waste of time to endeavor, by formula, diagram, and figures, to resolve the facts which impartial experiments on a small scale have so fully developed.

To convince you, sir, that I am not an individual who, as a '*plotter of absurdities*,' wishes to impose upon public credulity, I have not hesitated to risk any mechanical reputation which I may have earned, by publishing a treatise on the subject of the railway in question, a copy of which I had requested my publishers, Messrs. Sherwood, Gilbert and Piper, to send to you. In the short work alluded to, I have ventured upon a mathematical explanation of the cause of the advantage derivable from the adoption of *undulating* instead of *horizontal railways*. To that reasoning I beg to call your attention, and in the mean time permit me to assure you that I shall not for one instant defend a fallacy, if any of your correspondents will undertake to establish one. I cannot, however, bring myself to believe, although some '*barren spectators*,' as your correspondent terms them, may be inclined to found their faith on the empty assertions of 'Junius Redivivus,' adorned as they are by corresponding remarks on 'ice hills,' 'Russian mountains,' 'polished fly-wheels,' 'perpetual motion,' 'new fashioned water-wheels,' &c. &c., that such arguments will in any degree satisfy the inquiring minds of the great number of scientific men of declared reputation who *have witnessed* the experiments—who have considered them worthy of reflection—and who, as yet, have not made me acquainted with *the error* into which, if your opinion and your correspondent's be correct, I must (very innocently, I assure you,) have fallen.

I have recently requested the model engine to be returned to the Adelaide Rooms in London. You will, I hope, do me the honor to examine the experiments carefully, and if you find that a much greater velocity is attainable upon an undulating line with a given power than upon a horizontal line with the same power, and that greater weights can be conveyed upon one line than upon the other, I trust to your candor to make such declaration, or to show mathematically wherein the deception or fallacy consists.

'Junius Redivivus' argues as if I talked of *generating power* upon an undulating line. It is enough if I prove that *it can be economized*, or that greater loads can be carried, and a greater velocity be attained, than upon a horizontal line *with equal locomotive power*.

I should indeed be less deserving than I feel myself of the compliment paid me, in your *autographical plate*, by the enrolment of my name among the names of men with whom I never felt that I merited such an association—and as a *civil engineer*, a most unworthy member of the profession which I have recently embraced, were I to endeavor, first to palm a fallacy upon the public, and afterwards to insult science by endeavoring to establish that fallacy by false reasoning.

By way of rendering your correspondent, however, a little more instructive to your readers, I will beg him to inform them—

First, What would be the difference in fric-

tion between a carriage of any given weight, say one ton, traversing a curve 100 yards in extent, whose descending and ascending lines incline from the summit level at an average angle of $22\frac{1}{2}°$, and upon a horizontal line of like surface, drawn direct from summit to summit?

Secondly, What would be the difference in the velocity, or (in other words) in the time, which the same body would require to traverse such curve and such horizontal line, supposing it to commence upon the latter at a *maximum* velocity of five yards per second, and to commence the descending line and mount the summit of the ascending line of the curve at the same velocity?

When these questions are answered satisfactorily to your scientific readers, I will enter further into the practicability of my plan, and I hope I shall not find it difficult to prove that the adoption of a succession of curves upon a railway, whose summits are of equal altitude, for the purpose of saving power by the more economical use of steam, and increasing velocity, is not the only useful object of my invention—but that it especially applies to the rising of inclined planes, and to the prevention of excavation and embankments in many instances; while by the adoption of even occasional *single curves* the carriages may proceed under or over public roads, canals, &c. which might otherwise prove serious obstacles to railway lines, and across valleys, which might also prove sources of immense expense.

The esteem with which I have always regarded your useful publication, induces me to take a trouble on this occasion which the unceremonious, and occasionally uncourteous, remarks of your correspondent 'Junius Redivivus' do not, in my opinion, merit. If he can, however, *prove* the fallacy under which I labor, he will not be doing a greater service to the public than to J. W. N. Badnall.

P. S.—The line of road upon which, through the kindness of Mr. Giles, the engineer, I hope first to try the practical effect of my principle, whether on the level or up inclined planes, is the Newcastle and Carlisle Railway. The result will, I have no doubt, prove that the Rainhill and Sutton inclined planes, which are now the leading obstacles on the Liverpool and Manchester line, may be ascended with a facility which has not hitherto been contemplated.

[We have not yet received the explanatory pamphlet to which Mr. Badnall alludes, nor have we yet had an opportunity of seeing the model of his invention in operation. We can, therefore, say nothing at present either by way of retraction or confirmation of the opinion we have expressed on the subject. When we gave that opinion, we were not aware that Mr. Badnall was the patentee of the 'undulating railway'; and we most freely confess that if any one thing could shake our incredulity respecting it more than another, it would be the circumstance of its having a gentleman of his talents, information, and experience, for its author.—Ed. M. M.]

*On the Undulating Railway.* By Benjamin Cheverton. [From the London Mechanics' Magazine.]

Sir,—Your correspondent, 'Junius Redivivus,' is a clever writer, but an unpractised thinker. He was evidently not brought up a lawyer, to examine both sides of a question. He will do better in time, but at present he is apt to take a single view of things, and, therefore, an incomplete and superficial one, if I may be allowed to say so without giving him offence. But I should be reprehensible in so saying if I did not give an instance in proof of my assertion. I take, therefore, his last communication respecting the undulating railway.

I beg, however, at the very outset, clearly to be understood that I do not contend for any advantages which this sort of railway is alleged to possess over the ordinary level one—not even in theory, much less in practice; but I limit myself to the assertion that 'Junius Redivivus' has not exhibited the fallacy upon which he says the projector has stumbled, nor proved the existence of one. Is he aware of what has been done in the case—of the nature of the experiment shown at the Adelaide street Gallery of Practical Science and Works of Art? A carriage, whose moving power was a spring, was wound up to the same tension in each trial, by traversing it backwards a given distance on the floor. If placed alternately on the level and on the undulating railway, it was found that it travelled a certain distance in the same time, although the extremity of the latter railway was raised six inches above the level of the former. Now, where is the fallacy of which 'Junius Redivivus' speaks? Is it in the *fact*? and would he say with an engineer, a

friend of mine, that though he should see it he would not believe in it? All his arguments, indeed, go to prove that the thing is impossible; but on further consideration he may be inclined to suspect their relevancy to the subject he has taken in hand, rather than the accuracy of his sight. It may, however, be said that the fallacy lies in the inference drawn from these experiments as to the superior advantages of this new form of railway. It is admitted—but then why did not 'Junius Redivivus' apply himself to this point, detect the lurking error, and show that the experimental trials were not fairly instituted? Instead of this, he contents himself with general reasoning about the impossibility of power being self-generated, maintaining that 'what is gained by an accelerated motion down hill, is balanced by an up hill to ascend in turn;' that 'no more power can come out of a thing than that we put into it;' and with giving superfluous utterance to many more such truisms, about which, it is to be hoped, few of your readers need now to be instructed, except, perhaps, some two or three perpetual motion seekers.

I will myself become a 'schemer,' just to show 'Junius Redivivus' that all his arguments are thrown away, that they are altogether beside the question, by proving that they are equally applicable to the following as pretty a subject, *on paper*, as ever was seen. Let there be a series of axles elevated high above the ground, and placed at certain equal distances apart. They are to be actuated by a power sufficient to overcome their own friction on their bearings, and the resistance of the air to the motion of the carriage, &c. A swinging platform is to be suspended from each axle in the manner of a pendulum, and, at the extremities of the arcs which they describe, short roads are to be constructed in order to receive the carriage in its transit from one platform to the other. A slight sketch will explain my meaning better. (Sketch omitted.)

A B are axles; C D, platforms; F D, roads. On the arrival of the platform at E, the carriage, being on wheels, will, by its momentum, be carried over the road to the platform at C, and again be launched forward to its next stage, and so on in succession. Will 'Junius Redivivus' be so good as to point out any theoretic absurdity in this notable scheme, however preposterous it may be in a practical point of view. Unlike the undulating railway, its economy of power is acquivocable and undeniable, and yet it is equally open to all 'Junius Redivivus's' up-and-down-hill arguments, and which are in an equal degree irrelevant. If I were to say that the momentum of the platform and its carriage, acquired in the descent from D to F, was more than sufficient to carry it from F to E, I should be chargeable with the nonsense against which his arguments are directed; for 'the man should, indeed, be laughed at, who asserts that the power of a machine is multiplied by going up and down hill.' Nothing, however, of the kind is asserted, not even, as I understand, by the sanguine projector of the undulating railway, much less by its scientific friends; but it is contended, and, in reference to the scheme before your readers, with the full assurance of truth, that friction is diminished, and power, therefore, saved, but not multiplied, as 'Junius Redivivus' would have it. That there is less friction in this pendulum mode of conveyance than on a common railway, is evident from the circumstance of its being confined to a trifling motion of the axles in their bearings during the passage of the load through the much greater space of the arc, D E. Not that the diminution of the friction would be exactly in this proportion, for the wheels of the railroad carriage would have to be taken into the account. The case assimilates to that of a large wheel and a small one, and the saving would be in the proportion of the ratio of the pendulum rod and the radius of its axle to the ratio of the carriage wheel and its axle. The advantage here spoken of is unquestionable; but whether there would be less friction on an undulating than on a level railway, is a debateable point, and 'Junius Redivivus' should have combatted the affirmative instead of fighting a man of straw. He should have shown that friction would not be diminished at any part of the curve, or, admitting a diminution at any place or places, he should have instructed us how it would be compensated by an excess of friction. I need not say where or how—that is for 'Junius Redivivus' to do. The writer in the Athenæum is certainly wrong—not so much from taking an incorrect as an incomplete view of the subject. He has omitted all consideration of the centrifugal force that is generated, and which much influences the result. It may here be asked, how, then, did the

experiments exhibit results apparently so much in favor of the undulating railway? I cannot enter upon this point, as I have not investigated or even seen them; but there is no doubt that it arose principally, if not wholly, from the inertia of the carriage having been overcome by an extraneous force in the one case and not in the other. The projectors doubtless considered the experiment to be a fair one, but I hope they will not allow themselves to be self-deceived to their own bitter cost.

There is a sort of paradox connected with the subject, which it may be worth while to mention here, especially as I am inclined to think it is at the foundation of those fallacious views which the projectors and supporters of this scheme entertain. Among the latter are some whose eminence and position in the scientific world should have kept them from drawing crude and hasty conclusions. I have said that the axles B A, &c. are to be actuated by a power sufficient to overcome their own friction, the resistance of the air, and that opposed to the passing of the carriage over the roads D E, &c. Now, without further application of power, no progress can be made; but yet without any continual supply of it, as locomotion proceeds, and simply by a single additional effort in the first instance, effected by the descent of the machine from D to F, not only will the distance D E be accomplished, but another and another, even unto the world's end. That is to say, the initial force, though only just competent to produce motion of a given velocity, is effective for its prolongation at the same rate to any distance, or for any length of time. And this is true, not only of the present scheme, but also of the undulating railway. Oh! it is absurd, says 'Junius Redivivus,' and begins immediately to smell perpetual motion. He must remember that, by the terms of the proposition, all hindrance is provided against; the motion, therefore, is unimpeded, and no reason can be assigned why it should cease after it is once commenced. The paradox is only in the way of putting the case, for the like may be said of all machinery and moving bodies. It is probable, however, that some confused notions on this head may have led the projectors of the undulating railway to imagine that they had herein an exclusive advantage over the level railway, and that the succession of descents maintains the moving force which is first generated, forgetting that such force needs no supply for its maintenance, and that all that is requisite for its unimpaired existence is to provide that it shall not be exhausted by demands upon it to meet friction, &c. The same thing takes place on the ordinary railway, though not precisely in the same manner. At first the impelling power of the engine is greatly in excess above the resistance, and constitutes an accelerating moving force up to the point at which it is no longer in excess, or when a uniform motion is obtained. The steam power is now wholly employed in overcoming resistance, and *not* in producing motion, otherwise an accelerated velocity would take place. The motion, therefore, results from the force imparted to, and residing in, the machine, and will continue unchecked for any time or distance, if that force is not drawn upon for any other purpose. If it were an object of any moment to shorten the time in imparting to a carriage the inertia of motion, this may be obtained by a commencing inclined plane on a level railway, as well as on an undulating railway; but that any after advantage can be procured by a succession of them is wholly a mistake.

In connection with this subject and the before-mentioned place of exhibition, I beg, in conclusion, to draw attention to Mr. Saxton's very ingenious and original mode of propelling a carriage on a railway. It is a reversal in practice of the principle embodied in the windlass of unequal diameters.

I am, sir, yours, &c.

BENJAMIN CHEVERTON.

P. S.—Verily, our coachmakers are wonderfully ignorant of 'the application of the principles of science:' they have not gone deep in their studies, or 'Junius Redivivus' would not have been obliged to tell them that a plate of iron was stiffer placed on its edge than when laid flat. His scientific expedient of accommodating the tension of carriage springs to their load, 'by supplying the absence of flesh and blood by weights conveniently arranged, just as a ship takes ballast on board when her cargo is discharged,' reminds me of a mode of travelling which I noticed in Spain. Two persons being mounted on a mule, one on each side, the lighter pannier was balanced against the other with a load of stones. When 'Junius Redivivus' wrote this remark, 'that no more

power can come out of a thing than is put into it,' did it not remind him of his own proposal to employ a steam engine to work an air pump, for the purpose of having air guns instead of steam artillery? Surely he too is not 'one of those numerous unthinking people, who believe that, by making a simple machine complicated, they actually multiply their power,' or who imagine that they cannot produce a thing so well at first as they can at second hand.

These observations, as they are made in good part, so I hope they will be taken. They allude to mere specks, as it were, on the face of the sun, but which are blemishes notwithstanding.

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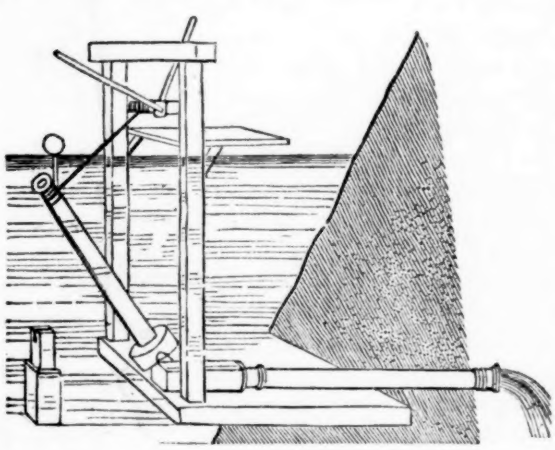
Draining.—[We insert the following cuts and descriptions as subjects of reflection for mechanics and farmers. There is a wide field for mechanical ingenuity in rural pursuits.]

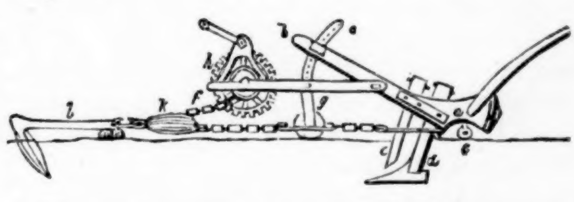
The inconvenience of an over-moist soil is but little felt in the neighborhood of the British metropolis. There are, however, many parts of England in which draining becomes a most important desideratum. The first thing to be attended to is the elevation of the part to be drained: and as in large drains it becomes necessary to keep the channels themselves open, it is advisable to employ an apparatus similar to that represented in the annexed engraving, to accomplish this object.



Now, if we suppose the place to be drained situated in the neighborhood of the sea, it will not be advisable to admit a free communication at all times; but it requires a free passage of water at stated periods, for the purpose of cleansing the drain, and at different heights. The diagonal tube, supported by the rope coiled round the cylinder, may be readily placed at any required angle. When we wish the water in the drain not to exceed a certain height, we have only to regulate the winch accordingly.

We have thus briefly noticed the drain on a large scale. A very simple mode of draining land, which is wet merely from the retentive nature of the soil, and which has been practised with success, consists in adding to the felly of a six-inch cart wheel a piece of wood, upon which is a triangular rim of iron. That side of the cart containing this prepared wheel is then loaded, till the piece of iron indents the soil to the depth of six or eight inches. These furrows are made in lines from five to ten yards asunder; the grass is merely pressed down, but not destroyed, and they generally grow up in the course of the year. They should, therefore, be made annually, at the approach of winter; but the work is so easily executed, that a single person, with two old horses, will go over from ten to twenty acres in eight hours.

Draining Plough.—This is a very important agricultural implement, of which we give a diagram.



We may suppose a case in which its powers would be indispensable. It becomes necessary to cut a trench for the passage of water; and the furrow being too deep for the common process, the anchor or hook, *l*, is inserted in the ground. We have thus a fixed point for resisting the action of the pulley, *k*. If power be now applied to the handle at top, it communicates motion to the wheel, *h*, with an enormous increase of power, and the acting portions of the plough, *c d*, are forced through the soil. The arrangement at *a b c* enables the conductor to give the required depth to the furrow. It will be obvious that the pulley, *g*, by resting on the ground, tends to diminish friction.—[British Cyclopædia.]

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Culture of Silk.—The Eaton Register says: Mrs. Alfred, of Newcum, Preble county, Ohio, has the present season, with the aid of one small girl and two boys, about 12 years old, fed and attended about 50,000 silk worms, with the leaves of a common

mulberry. From her labors, (about six weeks,) she will realize about $225, even should she sell the materials in a raw state. But should she manufacture the cocoons into sewing silk, which she does with ease and facility, the products of her labor will amount to near $400. The silk she manufactures is equal, for strength and evenness, to any foreign silk. Farmers, who can command some twenty or thirty mulberry trees, will find it a pleasant and profitable employment for some of their daughters. The necessary labors are simple, and easily attended to.

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Patent Radiator, or Globe Stove.—A stove, with the above name, has recently been invented by Mr. Walter Hunt, of this city, one of which was in operation a short time since at the Exchange. The main part of the stove where the coal is deposited is of a globular form, and from its peculiar construction, produces a greater quantity of heat from a given quantity of fuel than any other stove now in use. After repeated trials, the inventor informs us that it requires a very small quantity of fuel in comparison with many others now in use, and from what we witnessed we are disposed to entertain the same opinion. This article is well calculated for halls, churches, counting rooms, &c.; and, when once proved, will no doubt be generally sought after.

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Necessity and Invention.—A curious catalogue might be made of the shifts to which ingenious students in different departments of art have resorted, when, like Davy, they have wanted the proper instruments for carrying on their inquiries or experiments. His is not the first case in which the stores of an apothecary's shop are recorded to have fed the enthusiasm, and materially assisted the labors, of the young cultivator of natural science. The German chemist, Scheele, whose name ranks in his own department with the greatest of his time, was, as well as Davy, apprenticed in early life to an apothecary. While living in his master's house, he used secretly to prosecute the study of his favorite science by employing often half the night in reading the works that treated of it, or making experiments with instruments fabricated, as Davy's were, by himself, and out of equally simple materials.

Like the young British philosopher, too, Scheele is recorded to have sometimes alarmed the whole household by his detonations, an incident which always brought down upon him the severe anger of his master, and heavy menaces, intended to deter him from ever again applying himself to such dangerous studies, which, however, he did not long regard. It was at an apothecary's house that Boyle and his Oxford friends first held their scientific meetings, induced, as we are expressly told, by the opportunity they would thus have of obtaining drugs wherewith to make their experiments.

Newton lodged with an apothecary, while at school in the town of Grantham; and as, even at an early age, he is known to have been ardently devoted to scientific contrivances and experiments, and to have been in the habit of converting all sorts of articles into auxiliaries in his favorite pursuits, it is not probable that the various strange preparations which filled the shelves and boxes of his landlord's shop would escape his curious examination. Although Newton's glory chiefly depends upon his discoveries in abstract and mechanical science, some of his speculations, and especially some of his writings, on the subjects of light and color, show that the internal constitution of matter, and its chemical properties, had also much occupied his thoughts. Thus, too, in other departments, genius has found itself sufficient materials and instruments in the humblest and most common articles, and the simplest contrivances. Fergusson observed the places of the stars by means of a thread, with a few beads strung on it, and Tycho Brahe did the same thing with a pair of compasses. The self-taught American philosopher, Rittenhouse, being, when a young man, employed as an agricultural laborer, used to draw geometrical diagrams on his plough, and study them as he turned up the furrow. Pascal, when a mere boy, made himself master of many of the elementary propositions of geometry, without the assistance of any master, by tracing the figures on the floor of his room with a bit of coal. This, or a stick burned at the end, has often been the young painter's first pencil, while the smoothest and whitest wall he could find supplied the place of a canvass. Such, for example, were the commencing essays of the early Tuscan artist, Andrea del Castagno, who employed his leisure hours in this manner when he was a little boy tending cattle, till his performances at last attracted the notice of one of the Medici family, who placed him under a proper master. The famous Salvator Rosa

first displayed his genius for design in the same manner. To these instances may be added that of the late English musical composer, Mr. John Davy, who is said, when only six years old, to have begun the study and the practice of his art by imitating the chimes of a neighboring church with eight horse shoes, which he suspended by strings from the ceiling of a room in such a manner as to form an octave.—[Pursuit of Knowledge under Difficulties.]

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Method of pressing Oil in Corfu.—The manufacture of oil is the principal, and the machines employed in it are the rudest possible. The olives are pressed under a perpendicular stone wheel, which revolves in a large sized horizontal stone of a circular form, somewhat hollowed in the centre. A horse or mule sets the machinery in motion, and a peasant runs before and shovels the olives under the approaching wheel, the action of which is necessarily confined to a limited space, while its power is very insignificant. The bruised mass is then transferred to a bag made of rushes or mat, which is subjected to a heavy pressure; this pressure is increased by means of a screw, wrought by two men at irregular intervals; for the labor is so violent that they cannot possibly continue long at it. They ship two strong bars after the manner of a capstan, and then, with a most savage yell, they urge them forward by a simultaneous dart, the effect of which is marked by a quantity of oil oozing through the mat, and falling into a hole cut in the ground for its reception. After an interval of forty or fifty seconds, the laborers dart forward again with similar violence, and with a bodily effort which must strain their whole frame. The quantity of oil that two expert laborers can express in a day is estimated at ten or twelve jars of rather more than four gallons each.—[Hennen's Medical Topography of the Mediterranean.]

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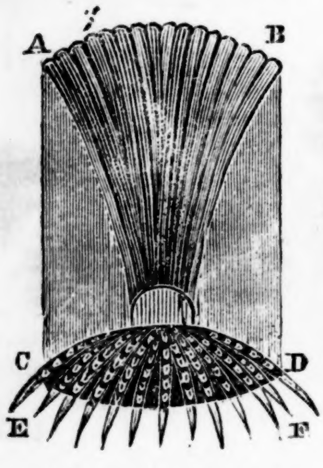
*Wonders of the Microscope.* [Arranged from Dr. Dick, on the Diffusion of Knowledge.]

In the universe we find all things constructed and arranged on the plan of *boundless and universal variety.* In the animal kingdom there have been actually ascertained about sixty thousand *different species* of living creatures. There are about 600 species of *mammalia*, or animals that suckle their young, most of which are quadrupeds—4000 species of *birds*, 3000 species of *fishes*, 700 species of *reptiles*, and 44,000 species of insects.* Besides these, there are about 3000 species of *shell fish*, and perhaps not less than eighty or a hundred thousand species of animalcules invisible to the naked eye; and new species are daily discovering, in consequence of the zeal and industry of the lovers of natural history. As the system of animated nature has never yet been thoroughly explored, we might safely reckon the number of species of animals of all kinds as amounting to at least *three hundred thousand.* We are next to consider that the organical structure of each species consists of an immense multitude of parts, and that all the species are infinitely diversified—differing from each other in their forms, organs, members, faculties, and motions. They are of all shapes and sizes, from the microscopic animalculum, ten thousand times less than a mite, to the elephant and the whale. They are different in respect of the construction of their sensitive organs. In regard to the *eye*, some have this organ placed in the front, so as to look directly forward, as in man; others have it so placed as to take in nearly a whole hemisphere, as in birds, hares, and conies; some have it fixed, and others moveable; some have *two* globes or balls, as quadrupeds; some have *four*, as snails, which are fixed in their horns; some have *eight*, set like a locket of diamonds, as spiders; some have several *hundreds*, as flies and beetles, and others above *twenty thousand*, as the dragon-fly and several species of butterflies. In regard to the *ear*—some have it large, erect, and open, as in the hare, to hear the least approach of danger; in some it is covered to keep out noxious bodies; and in others, as in the mole, it is lodged deep and backward in the head, and fenced and guarded from external injuries. With regard to their *clothing*—some have their bodies covered with hair, as quadrupeds; some with feathers, as birds; some with scales, as fish; some with shells, as the tortoise; some only with skin; some with stout and firm armor, as the rhinoceros; and others with prickles, as the hedgehog and porcupine—all nicely accommodated to the nature of the animal and the element in which it lives. These coverings, too, are adorned with *diversified* beauties; as appears in the plumage of birds, the feathers of the peacock, the scales of the finny tribes,

* Specimens of all these species are to be seen in the magnificent collections in the Museum of Natural History at Paris.

the hair of quadrupeds, and the variegated polish and coloring of the tropical shell-fish—beauties which, in point of symmetry, polish, texture, variety, and exquisite coloring, mock every attempt of human art to copy or to imitate.

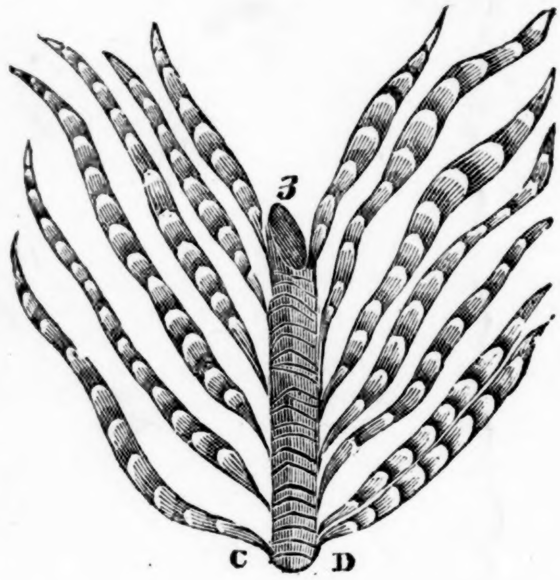
Not only in the objects which are visible to the unassisted eye, but also *in those which can only be perceived by the help of microscopes*, is the characteristic of *variety* to be seen. In the scales of fishes, for example, we perceive an infinite number of diversified specimens of the most curious workmanship. Some of these are of a longish form, some round, some triangular, some square; in short, of all imaginable variety of shapes. Some are armed with sharp prickles, as in the perch and sole;* some have smooth edges, as in the tench and codfish; and even in the same fish there is a considerable variety, for the scales taken from the belly, the back, the sides, the head, and other parts, are all different from each other. In the scale of a perch we perceive one piece of delicate mechanism, in the scale of a had-





dock† another, and in the scale of a sole beauties different from both.

We find some of them ornamented with a prodigious number of concentric flutings, too near each other and too fine to be easily enumerated. These flutings are frequently traversed by others diverging from the centre of the scale, and proceeding from thence in a straight line to the circumference. On every fish there are many thousands of these variegated pieces of mechanism. A small part of the feather of a peacock,* one-thirtieth of an inch in length, appears no less



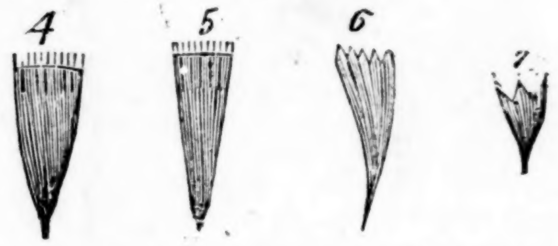

beautiful than the whole feather does to the naked eye, exhibiting a multitude of bright shining parts, reflecting first one color and then another in the most vivid manner. The *wings* of all kinds of insects, too, present an infinite variety, no less captivating to the mind than pleasing to the eye. They appear strengthened and distended by the finest bones, and covered with the lightest membranes. Some of them are adorned with neat and beautiful feathers, and many of them provided with the finest articulations and foldings for the wings, when they are withdrawn and about to be folded up in their cases. The thin membranes of the wings appear beautifully divaricated with thousands of little points, like silver studs. The wings of some flies are *filmy*, as the dragon-fly; others have them stuck over with short *bristles*, as the flesh-fly; some have rows of feathers along their ridges, and borders round their edge, as in gnats; some have hairs, and others have hooks, placed with the greatest

* Fig. 1 represents the *scale* of a *sole-fish* as it appears through a good microscope. C D E F represents that part of the scale which appears on the outside of the fish, and A B C D the part which adheres to the skin, being furrowed, that it may hold the faster. It is terminated by pointed spikes, every alternate one being longer than the interjacent ones.

† Fig. 2 is the scale of a haddock, which appears divaricated like a piece of net-work.

* Fig. 3 represents a small portion or fibre of the *feather of a peacock*, only one-thirtieth of an inch in extent, as it appears in the microscope. The small fibres of these feathers appear, through this instrument, no less beautiful than the whole feather does to the naked eye. Each of the sprigs or hairs on each side of the fibre, as C D, D C, appears to consist of a multitude of bright shining parts, which are a congeries of small plates, &c. The under sides of each of these plates are very darkand opaque, reflecting all the rays thrown upon them like the foil of a looking-glass; but their upper sides seem to consist of a multitude of exceedingly thin plated bodies, lying close together, which, by various positions of the light, reflect first one color and then another, in a most vivid and surprizing manner.

regularity and order. In the wings of moths and butter-flies there are millions of small feathers of different shapes,* diversified with the greatest variety of bright and vivid co-




lors, each of them so small as to be altogether invisible to the naked eye.

The variety of forms in which *animal life* appears, in those invisible departments of creation which the microscope has enabled us to explore, is truly wonderful and astonishing. Microscopic animals are so different from those of the larger kinds, that scarcely any analogy seems to exist between them; and one would be almost tempted to suppose that they lived in consequence of laws directly opposite to those which preserve man and the other larger animals in existence. When we endeavor to explore this region of animated nature, we feel as if we were entering on the confines of a new world, and surveying a new race of sentient existence. The number of these creatures exceeds all human calculation. Many hundreds of species, all differing in their forms, habits, and motions, have already been detected and described, but we have reason to believe that by far the greater part is unexplored, and perhaps forever hid from the view of man. They are of all shapes and forms: some of them appear like minute atoms, some like globes and spheroids, some like hand-bells, some like wheels turning on an axis, some like double-headed monsters, some like cylinders, some have a worm-like appearance, some have horns, some resemble eels, some are like long hairs, one hundred and fifty times as long as they are broad, some like spires and cupolas, some like fishes, and some like animated vegetables. Some of them are almost visible to the naked eye, and some so small that the breadth of a human hair would cover fifty or a hundred of them, and others so minute that millions of millions of them might be contained within the compass of a square inch.

* Figs. 4, 5, 6, 7, represent some of the different kinds of feathers which constitute the dust which adheres to the wings of moths and butterflies, and which, in the microscope, appear tinged with a variety of colors. Each of these feathers is an object so small as to be scarcely perceptible to the naked eye.

In every pond and ditch, and almost in every puddle, in the infusions of pepper, straw, grass, oats, hay, and other vegetables, in paste and vinegar, and in the water found in oysters, on almost every plant and flower, and in the rivers, seas, and oceans, these creatures are found in such numbers and variety as almost to exceed our conception or belief. A class of these animals, called *Medusæ*, has been found so numerous as to discolor the ocean itself. Captain Scoresby found the number in the olive-green sea to be immense. A cubic inch contained sixty-four, and consequently a cubic mile would contain 23,888,000,000,000,000; so that, if one person should count a million in seven days, it would have required that eighty thousand persons should have started at the creation of the world to have completed the enumeration at the present time. Yet, all the minute animals to which we now allude are furnished with numerous organs of life as well as the larger kind, some of their internal movements are distinctly visible, their motions are evidently *voluntary*, and some of them appear to be possessed of a considerable degree of sagacity, and to be fond of each other's society.*

In short, it may be affirmed without the least hesitation, that the beauties and *varieties* which exist in those regions of creation which are invisible to the unassisted eye are far more numerous than all that appears to a common observer in the visible economy of nature. How far this scene of creating power and intelligence may extend beyond the range of our microscopic instruments, it is impossible for mortals to determine; for the finer our glasses are, and the higher the magnifying powers we apply, the more numerous and varied are the objects which they exhibit to our view. And as the largest

* The following extract from Mr. Baker's description of the *hair-like animalcule* will illustrate some of these positions. A small quantity of the matter containing these animalcules having been put into a jar of water, it so happened that one part went down immediately to the bottom, while the other continued floating on the top. When things had remained for some time in this condition, each of these swarms of animalcules began to grow weary of its situation, and had a mind to change its quarters. Both armies, therefore, set out at the same time, the one proceeding upwards and the other downwards; so that after some time they met in the middle. A desire of knowing how they would behave on this occasion engaged the observer to watch them carefully; and, to his surprize, he saw the army that was marching upwards open to the right and left, to make room for those that were descending. Thus, without confusion or intermixture, each held on its way; the army that was going up marching in two columns to the top, and the other proceeding in one column to the bottom, as if each had been under the direction of wise leaders.

telescope is insufficient to convey our views to the boundaries of the great universe, so we may justly conclude that the most powerful microscope that has been or ever will be constructed will be altogether insufficient to guide our views to the utmost limits of the descending scale of creation.

We shall now continue our illustrations :

Fig. 1 represents a *mite*, which has eight legs, with five or six joints in each, two feelers, a small head in proportion to its body, a sharp snout and mouth like that of a mole, and two little eyes. The body is of an oval form, with a number of hairs like bristles issuing from it, and the legs terminate in two hooked claws.

Fig. 2 represents a microscopic animal which was found in an infusion of *anemony*. The surface of its back is covered with a fine mask, in the form of a *human face ;* it has three feet on each side, and a tail which comes out from under the mask.


Fig. 3 is an animalcula found in the infusion of *old hay*. A shows the head, with the mouth opened wide, and its lips furnished with numerous hairs ; B is its forked tail ; D its intestines, and C its heart, which may be seen in regular motion. The circumference of the body appears indented like the teeth of a saw.


Fig. 4 shows the *wheel-animal*, or *vorticella*. It is found in rain-water that has stood some days in leaden gutters, or in hollows of lead on the tops of houses. The most remarkable part of this animalcula is its *wheel-work*, which consists of two semi-circular instruments, round the edges of which many little fibrillæ move themselves very briskly, sometimes with a kind of rotation, and sometimes in a trembling or vibratory manner. Sometimes the wheels seem to be entire circles, with teeth like those of the balance-wheel of a watch ; but their figure varies according to the degree of their protusion, and seems to depend upon the will of the animal itself ; *a* is the head and wheels, *b* is the *heart*, where its systole and diastole are plainly visible, and the alternate motions of contraction and dilatation are performed with great strength and vigor, in about the same time as the pulsation of a man's artery. This animal assumes various shapes, one of which is represented at Fig. 5, and becomes occasionally a case for all the other parts of the body.

Fig. 6 represents *an insect with net-like arms*. It is found in cascades where the water runs very swift. Its body appears curiously turned as on a lathe, and at the tail are three sharp spines, by which it raises itself and stands upright in the water ; but the most curious apparatus is about its head, where it is furnished with two instruments, like fans or nets, which serve to provide its food. These it frequently spreads out and draws in again, and, when drawn up, they are folded together with the utmost nicety and exactness. When this creature does not employ its nets, it thrusts out a pair of sharp horns, and puts on a different appearance, as in Fig. 7, where it is shown magnified about 400 times.

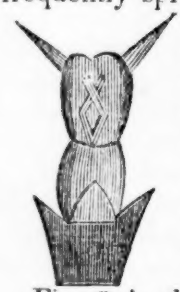



Fig. 8 is the representation of an animalcula found in the infusion of *the bark of an oak*. Its body is composed of several ringlets, that enter one into another, as the animal contracts itself. At *a b* are two lips, furnished wi h moveable hairs ; it pushes out of its mouth a *snout* composed of several pieces sheathed in each other, as at *e*. A kind of horn, *d*, is sometimes protruded from the breast, composed of furbelows, which slide into one another like the drawers of a pocket telescope.

Fig. 9 is another animalcula, found in the same infusion, called a *tortoise*, with an umbilical tail. It stretches out and contracts itself very easily, sometimes assuming a round figure, which it retains only for a moment, then opens its mouth to a surprizing width, forming nearly the circumference of a circle. Its motion is very surprizing and singular.

Fig. 10 is an animalcula, called ***great mouth***, which is found in several infusions. Its mouth takes up half the length of its body; its inside is filled with darkish spots, and its hinder part terminated with a singular tail.


Fig. 11 represents the *proteus*, so named on account of its assuming a great number of different shapes. Its most common shape bears a resemblance to that of a swan, and it swims to and fro with great vivacity. When it is alarmed, it suddenly draws in its long neck, transforming itself into the shape represented at *m*, and at other times it puts forth a new head and neck, with a kind of wheel machinery, as at *n*.

Fig. 12 exhibits a species of animalcula shaped like bells with long tails, by which they fasten themselves to the roots of *duck-weed*, in which they were found. They dwell in colonies, from ten to fifteen in number.

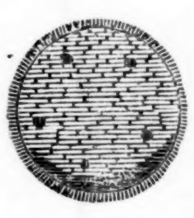


Fig. 13 is the *globe animal*, which appears exactly globular, having no appearance of either head, tail, or fins. It moves in all directions, forwards or backwards, up or down, either rolling over and over like a bowl, spinning horizontally like a top, or gliding along smoothly without turning itself at all. When it pleases, it can turn round, as it were upon an axis, very nimbly, without removing out of its place. It is transparent, except where the circular black spots are shown; it sometimes appears as if dotted with points, and beset with short moveable hairs or bristles, which are probably the instruments by which its motions are performed.


Fig. 14 shows a species of animalculæ called *soles*, found in infusions of straw and the ears of wheat; *o* is the mouth, which is sometimes extended to a great width, *p* is the tail.

Fig. 15 represents an animal found in an infusion of citron flowers. Its head is very short, and adorned with two horns like those of a deer; its body appears to be covered with scales, and its tail long, and swift in motion.

Fig. 16 is a representation of the *eels* which are found in paste and stale vinegar. The most remarkable property of these animals is that they are *viviparous*. If one of them is cut through near the middle, several oval bodies of different sizes issue forth, which are young *anguillæ*, each coiled up in its proper membrane. A hundred and upwards of the young ones have been seen to issue from the body of one single eel, which accounts for their prodigious increase.

It may not be improper to remark, that no engraving can give an adequate idea of the objects referred to above; and, therefore, whoever wishes to inspect nature in all her minute beauties and varieties must have recourse to the microscope itself.

What we already know of these unexplored and inexplorable regions gives us an amazing conception of the intelligence and wisdom of the Creator, of the immensity of his nature, and of the infinity of ideas which, during every portion of past duration, must have been present before his all-comprehensive mind. What an immense space in the scale of animal life intervenes between an *animalcule*, which appears only the size of a visible point, when magnified 500,000 times, and a *whale*, a hundred feet long and twenty broad! The proportion of bulk between the one of these beings and the other is nearly as 34,560,000,000,000,000,000 to 1. Yet all the intermediate space is filled up with animated beings of every form and order! A similar variety obtains in the vegetable kingdom. It has been calculated, that some plants which grow on *rose* leaves, and other shrubs, are so small that it would require more than a thousand of them, to equal in bulk a single plant of *moss;* and if we compare a stem of moss, which is generally not above one-sixtieth of an inch, with some of the large trees in Guinea and Brazil of twenty feet diameter, we shall find the bulk of the one will exceed that of the other no less than 2,985,984,000,000 times, which multiplied by 1,000 will produce 2,985,984,000,000,000, the number of times which the large tree exceeds the rose-leaf plant. Yet this immense interval is filled up with plants and trees of every form and size! With good reason, then, may we adopt the language of the inspired writers,—"How *manifold* are thy works, O Lord! In wisdom hast thou made them all."

## METEOROLOGICAL RECORD, KEPT IN THE CITY OF NEW-YORK,

*From the 22d day of September to the 18th of October, 1833, inclusive.*

[Prepared for the Mechanics' Magazine and Register of Inventions and Improvements.]

| *Date.* | *Hours.* | *Thermometr.* | *Barometer.* | *Winds.* | *Strength of Wind.* | *Clouds from what direction.* | *Weather.* |
|---|---|---|---|---|---|---|---|
| Sept'r 22.. | 6 a. m. | 54 | 30.20 | NNE | moderate | SW by S | fair |
| | 10 | 60 | 30.25 | ..—N by E | .. | .. | ..—thin variegated *cirri* from SSW |
| | 2 p. m. | 64 | 30.23 | N by E | .. | .. | ..— .. .. .. |
| | 6 | 62 | 30.21 | .. | light | { SW / N by E } | ..— .. .. .. |
| | 10 | 58 | 30.21 | .. | .. | SW by S | .. |
| " 23.. | 6 a. m. | 53 | 30.20 | NE | moderate | .. | .. |
| | 10 | 62 | 30.22 | ENE | fresh | .. | .—detached *cirri*, beautifully variegated |
| | 2 p. m. | 64 | 30.16 | .. | moderate | SSW | .— .. .. .. |
| | 6 | 63 | 30.15 | .. | .. | .. | ..— .. .. .. |
| | 10 | 60 | 30.10 | | light | | .. |
| " 24.. | 10 a. m. | 53 | 30.01 | N by W | .. | WSW | fair |
| | 10 | 60 | 30.02 | WSW | | .. | .. |
| | 2 p. m. | 68 | 29.97 | .. | moderate | .. | .. |
| | 6 | 64 | 29.92 | .. | light | | clear |
| | 10 | 58 | 29.98 | | | | .. |
| " 25.. | 6 a. m. | 55 | 30.00 | WSW—WNW | light | | .. |
| | 10 | 64 | 30.04 | SW | .. | WSW | fair |
| | 2 p. m. | 72 | 30.00 | .. | .. | . | .. |
| | 6 | 69 | 30.00 | .. | .. | .. | .. |
| | 10 | 66 | 30.00 | | .. | | clear |
| " 26.. | 6 a. m. | 62 | 29.99 | SW—WSW | .. | .. | fair |
| | 10 | 69 | 29.98 | SW by W | .. | .. | .. |
| | 2 p. m. | 75 | 29.90 | SW | moderate | .. | .. |
| | 6 | 70 | 29.86 | .. | .. | | clear |
| | 10 | 66 | 29.86 | | .. | | .. |
| " 27.. | 6 a. m. | 63 | 29.84 | WSW | .. | | .. |
| | 10 | 70 | 29.89 | | .. | ..—WNW | fair |
| | 2 p. m. | 78 | 29 88 | W—WSW | .. | .. | ..—with brisk scuds from WNW |
| | 6 | 76 | 29·90 | WSW | .. | NW—WSW | .. |
| | 10 | 73 | 30.— | .. | light | WSW | .. |
| " 28.. | 6 a. m. | 62 | 30.14 | ENE | .. | W by S | .. |
| | 10 | 65 | 30.18 | E—SE | moderate | { .. / SW } | .. |
| | 2 p. m. | 67 | 30.15 | SE—ESE | .. | { W by S / SE } | .. —cloudy at 5.30 |
| | 6 | 65 | 30.15 | SE | .. | { W by S / S } brisk | cloudy |
| | 10 | 66 | 30.10 | .. | .. | S by W | .. |
| " 29.. | 6 a m | 68 | 30.08 | SSE | .. | { WSW / SSW } | fair |
| | 10 | 75 | 30 08 | .. | .. | .. | .. |
| | 2 p. m. | 78 | 30.04 | .. | .. | SW | .. |
| | 6 | 75 | 30.02 | .. | .. | WSW | .. —cloudy at W |
| | 10 | 70 | 30.06 | .. | .. | .. | .. |
| " 30.. | 6 a. m. | 63 | 30.17 | NNW | ligqt—mod. | .. | .. |
| | 10 | 70 | 30.23 | .. | moderate | .. | .. |
| | 2 p. m. | 74 | 30.21 | .. | .. | .. | .. |
| | 6 | 70 | 30.21 | .. | light | .. | .. |
| | 10 | 67 | 30.24 | .. | | | .. |
| October 1.. | 6 a. m. | 58 | 30.27 | ENE | moderate | .. | hazy —cloudy |
| | 10 | 64 | 30.27 | .. | .. | { .. / ENE } | cloudy |
| | 2 p. m. | 62 | 30.16 | .. | fresh | ENE | rainy —rain |
| | 6 | 57 | 30.08 | .. | .. | .. | rain |
| | 10 | 60 | 30.01 | —SSE | ..—gale | | .. |
| " 2.. | 6 a. m. | 69 | 29.80 | ..—S—SSW | moderate | SW—WSW | .. —cloudy —rainy |
| | 10 | 78 | 29.80 | WSW—W | .. | WSW | fair |
| | 2 p. m. | 72 | 29.77 | WSW | .. | .. | .. |
| | 6 | 66 | 29.81 | W by S | .. | .. | .. |
| | 10 | 60 | 29.89 | | .. | | clear |
| " 3.. | 6 a. m. | 56 | 29.95 | WSW | .. | | .. |
| | 10 | 63 | 29.98 | .. | .. | —WSW | .. —fair |
| | 2 p. m. | 67 | 29.98 | .. | .. | .. | fair |
| | 6 | 63 | 30.01 | .. | .. | .. | .. |
| | 10 | 58 | 30.07 | .. | .. | .. | .. |
| " 4.. | 6 a. m. | 51 | 30.20 | NNW | .. | .. | .. |
| | 10 | 57 | 30.27 | .. | .. | NNW | .. —small scuds from NNW |
| | 2 p. m. | 58 | 30.28 | N by W | .. | NW | .. |
| | 6 | 56 | 30.35 | N | light | | clear |
| | 10 | 53 | 30.40 | | | | .. |
| " 5.. | 6 a. m. | 48 | 30.52 | N by W—NE—E | .. | | .. |

CITY OF NEW-YORK—CONTINUED.

| *Date.* | *Hours.* | *Thermometr.* | *Barometer.* | *Winds.* | *Strength of Wind.* | *Clouds from what direction.* | *Weather.* |
|---|---|---|---|---|---|---|---|
| October 5.. | 10 a. m. | 56 | 30.52 | ESE—NW | faint | ESE | fair |
| | 2 p. m. | 62 | 30.49 | SSW—SE | light | SE | .. |
| | 6 | 58 | 30.48 | SSE | .. | SSE | .. |
| | 10 | 56 | 30.45 | | calm | | .. |
| " 6.. | 6 a. m. | 58 | 30.37 | | .. | SSW | cloudy |
| | 10 | 64 | 30.37 | SW—S | light | SW | .. —fair |
| | 2 p. m. | 68 | 30.31 | SSW | .. | .. | .. |
| | 6 | 62 | 30.28 | .. | .. | .. | .. |
| | 10 | 61 | 30.28 | | .. | | .. |
| " 7.. | 6 a. m. | 58 | 30.25 | WSW—SSW | faint | WSW | hazy |
| | 10 | 63 | 30.24 | SSW—ESE | .. | SW | fair |
| | 2 p. m. | 67 | 30.22 | SE | .. | .. | cloudy |
| | 6 | 64 | 30.19 | .. | calm | .. | .. |
| | 10 | 64 | | | | .. | .. |
| " 8.. | 6 a. m. | 64 | 29.90 | SE—SSE | fr'h—strong | SSE | rain —rain scuds from SSE. |
| | 10 | 66 | 29.83 | S by E | ..—mod. | .. | .. |
| | 2 p. m. | 67 | 29.75 | S—SW—WSW | mod.—fresh | { S / SSW } | fair |
| | 6 | 62 | 29.77 | WSW | strong | SW | .. |
| | 10 | 57 | 29.75 | .. | .. | | cloudy |
| " 9.. | 6 a. m. | 60 | 29.84 | SW—WNW | mod.—fresh | NW b W-brisk | fair |
| | 10 | 66 | 29.91 | NNW | fresh | .. | .. |
| | 2 p. m. | 69 | 29.91 | NW | moderate | .. | .. |
| | 6 | 66 | 29.91 | NNW | light | | clear |
| | 10 | 61 | 29.97 | | calm | | .. |
| " 10.. | 6 a. m. | 58 | 29.91 | SW | ..—faint | SW | fair |
| | 10 | 64 | 29.90 | .. | light | .. | .. |
| | 2 p. m. | 69 | 29.80 | WSW | mod.-fresh | WSW | .. |
| | 6 | 66 | 29.80 | WNW | frh-str-gale | W | cloudy and squally —fair |
| | 10 | 49 | 29.98 | .. | gale—mod. | | fair |
| " 11.. | 6 a. m. | 42 | 30.18 | .. | moderate | NW | clear —fair |
| | 10 | 48 | 30.21 | .. | .. | | .. |
| | 2 p. m. | 52 | 30.20 | NW—WNW | .. | W by S | .. —fair —haze from W by S |
| | 6 | 55 | 30.20 | NNW | light | .. | hazy |
| | 10 | 51 | 30.21 | | calm | | cloudy |
| " 12.. | 6 a. m. | 48 | 30.14 | ENE—E—SE | light | SW by W | .. |
| | 10 | 54 | 30.15 | ESE & SE | mod.—fresh | { SW / SE } | .. |
| | 2 p. m. | 62 | 29.93 | SE—ESE | strong | .. .. | .. —rainy |
| | 6 | 60 | 29.79 | ESE | —gale | | rain |
| | 10 | 63 | 29.57 | | .. | | .. |
| " 13.. | 6 a. m. | 55 | 29.30 | NNW | .. | { WNW slow / NNW brisk } | rainy —cloudy —rain —cloudy |
| | 10 | 55 | 29.40 | WNW—W | .. | { WNW / NW } | fair —cloudy —fair |
| | 2 p. m. | 56 | 29.50 | W by S—WSW | strong—fr'h | WNW | fair —cloudy |
| | 6 | 58 | 29.62 | WSW | fr'h—strong | W by N | cloudy —fair |
| | 10 | 52 | 29.72 | WNW | strong | | fair |
| " 14.. | 6 a. m. | 49 | 29.94 | WSW—WNW | mod.--fresh | NNW | .. |
| | 10 | 55 | 30.03 | WNW | fresh | .. | .. |
| | 2 p. m. | 58 | 30.04 | .. | .. | .. | .. |
| | 6 | 56 | 30.08 | .. | light | | .. —haze at SW |
| | 10 | 52 | 30.15 | | calm | | .. .. N |
| " 15.. | 6 a. m. | 52 | 30.17 | WSW | faint | W by S | cloudy |
| | 10 | 56 | 30.19 | variable | ..—light | .. | .. —fair |
| | 2 p. m. | 62 | 30.10 | SSE | light | { W / W by S } | fair—cloudy |
| | 6 | 61 | 30.03 | .. | .. | W by S | cloudy |
| | 10 | 61 | 30.04 | | .. | | .. |
| " 16.. | 6 a. m. | 64 | 29.96 | S—SW | moderate | SW by W | .. |
| | 10 | 67 | 29.98 | SSW | .. | SW | .. |
| | 2 p. m. | 70 | 29.91 | S | .. | .. | .. |
| | 6 | 68 | 29.89 | .. | light | .. | .. |
| | 10 | 66 | 29.90 | .. | .. | .. | fair —storm |
| " 17.. | 6 a. m. | 64 | 29.82 | .. | .. | .. | cloudy |
| | 10 | 65 | 29.80 | SSE | .. | .. | .. |
| | 2 p. m. | 69 | 29.77 | ESE | —fresh | .. | rainy —fair |
| | 6 a. m. | 67 | 29.70 | SSE | moderate | { SSW / SSE } | fair—light scuds from SSE |
| | 10 | 67 | 29.60 | .. | strong | .. .. | .. |
| " 18.. | 6 a. m. | 53 | 29.85 | WSW | .. | | .. |
| | 10 | 52 | 29.90 | SSW | .. | SSW | .. |
| | 2 p. m. | 57 | 29.95 | WSW | moderate | .. | cloudy —fair |
| | 6 | 53 | 30.07 | | .. | .. | fair |
| | 10 | 50 | 30.18 | —NW | | | . |

**Maximum height of the barometer for September 30.20 in.—Minimum, 29.84 in.—Range, 0.46 in.**

CITY OF NEW-YORK—CONTINUED.

The observations of winds for September result as follows: From the North-Eastern quarter, 25¼—from the South Eastern, 13¼—South-Western, 64¼—and North-Western, 29¼.

The higher currents, as observed by the course of the highest clouds, show the following results: From the North-Eastern quarter, 9—from the South-Eastern, 3—South-Western, 89¼—and North-Western, 20¼.

## METEOROLOGICAL RECORD, KEPT AT AVOYLLE FERRY, RED RIVER, LOU.

*For the months of August and September*, 1833—(*Lat.* 31.10 *N.*, *Long.* 91.59 *W. nearly.*)

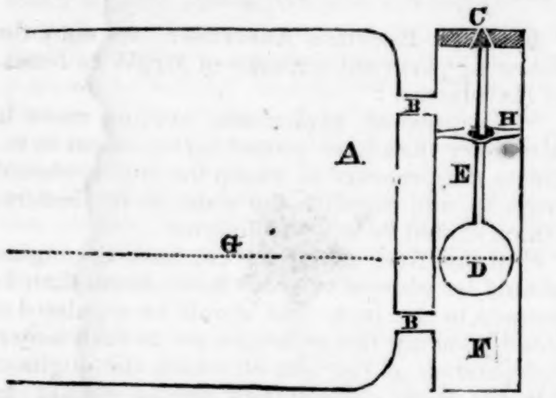
| *Date.* | *Thermometer.* | | | *Wind.* | *Weather, Remarks, &c.* |
|---|---|---|---|---|---|
| 1833. | Morn'g. | Noon. | Night. | | |
| August 1 | 75 | 86 | 78 | calm | clear all day—Red River falling |
| " 2 | 74 | 88 | 76 | .. | .. .. |
| " 3 | 75 | 88 | 84 | .. | .. .. |
| " 4 | 78 | 88 | 82 | SW—light | cloudy |
| " 5 | 78 | 92 | 86 | .. | clear—evening calm and cloudy |
| " 6 | 78 | 80 | 76 | calm | .. morning—11 a.m. fine shower fr NW—heavy thunder and rain in even'g |
| " 7 | 74 | 89 | 84 | .. | .. .. —evening cloudy—sowed turnips, cale, cresses, lettuce, and [radish seed |
| " 8 | 78 | 90 | 86 | .. | clear—martin birds left here |
| " 9 | 78 | 89 | 84 | NE | .. —flying clouds—evening and night, showers |
| " 10 | 77 | 88 | 80 | W | cloudy all day—sweet potatoes very large for use |
| " 11 | 79 | 85 | 80 | SW | .. —thunder showers evening |
| " 12 | 78 | 88 | 83 | .. —light | clear—evening calm |
| " 13 | 73 | 88 | 85 | calm | .. —Red River fell this month 7 feet 10 inches, and off the flat |
| " 14 | 74 | 90 | 86 | .. | .. |
| " 15 | 74 | 90 | 87 | NW | .. —evening calm and cloudy |
| " 16 | 74 | 87 | 82 | N—high | .. —flying clouds |
| " 17 | 68 | 84 | 80 | NW—light | .. |
| " 18 | 67 | 87 | 78 | .. | .. |
| " 19 | 67 | 86 | 82 | W—light | .. |
| " 20 | 69 | 88 | 84 | calm | .. |
| " 21 | 72 | 89 | 82 | NE—light | .. —light flying clouds |
| " 22 | 69 | 89 | 83 | .. | .. —evening calm |
| " 23 | 72 | 91 | 82 | N | .. — .. cloudy, and thunder, no rain |
| " 24 | 74 | 91 | 81 | calm | cloudy |
| " 25 | 74 | 90 | 82 | NE—light | clear |
| " 26 | 73 | 89 | 82 | calm | .. |
| " 27 | 71 | 88 | 84 | .. | .. |
| " 28 | 70 | 89 | 83 | NE—light | .. —light flying clouds |
| " 29 | 70 | 89 | 83 | .. | .. — .. .. .. |
| " 30 | 71 | 89 | 78 | .. | .. —evening calm and cloudy |
| " 31 | 71 | 88 | 79 | .. | cloudy |
| Sept'r 1 | 72 | 88 | 82 | .. | .. —Red River falling |
| " 2 | 71 | 88 | 81 | .. | clear |
| " 3 | 70 | 87 | 82 | calm | .. |
| " 4 | 71 | 87 | 78 | E | light showers & sunshine—evening calm & cloudy—Red River fell 5 inches |
| " 5 | 74 | 86 | 77 | NE—strong | cloudy—at 3 a. m commenced raining and continued very heavy to 1 p. m.* |
| " 6 | 74 | 86 | 83 | SE—light | clear—flying clouds—evening calm—Red River rising |
| " 7 | 78 | 87 | 80 | calm | .. evening—light showers |
| " 8 | 74 | 86 | 82 | .. | .. |
| " 9 | 72 | 88 | 82 | .. | .. —Red River risen 22 inches, now falling |
| " 10 | 77 | 88 | 82 | .. | cloudy morning—from 10 a. m. wind NE and clear—night cloudy |
| " 11 | 75 | 86 | 83 | .. | clear |
| " 12 | 73 | 87 | 85 | .. | .. |
| " 13 | 72 | 86 | 80 | .. | .. —light shower at 1 p. m. |
| " 14 | 75 | 86 | 79 | SW | .. morning—light showers—calm—cloudy evening |
| " 15 | 74 | 85 | 83 | W | .. —flying clouds—evening calm and sultry |
| " 16 | 76 | 86 | 83 | calm | .. —light breezes from S |
| " 17 | 77 | 83 | 80 | .. | .. |
| 18 | 75 | 86 | 82 | SE | .. |
| 19 | 72 | 85 | 78 | calm | .. —Red River fell since the 9th, 22 inches |
| " 20 | 71 | 88 | 82 | .. | .. |
| " 21 | 71 | 74 | 73 | NE | cloudy—night calm and clear |
| " 22 | 60 | 73 | 68 | N | clear |
| " 23 | 58 | 75 | 70 | calm | .. |
| " 24 | 62 | 76 | 73 | N | .. —calm evening |
| " 25 | 62 | 79 | 77 | NW | .. — .. .. |
| " 26 | 65 | 81 | 78 | calm | .. |
| " 27 | 65 | 84 | 79 | .. | .. |
| " 28 | 74 | 87 | 80 | SW—light | cloudy—clear evening |
| " 29 | 70 | 87 | 80 | calm | clear |
| " 30 | 72 | 87 | 77 | S—light | at 4 p. m. thunder shower—heavy showers all night. |

* Sept. 5th—severe flaws of wind all day; evening and night heavy showers: at night wind severe form E to SE.

*August*—Red River fell from the 1st to the 13th, 7 feet 10 inches, and from the 14th to the 31st, 9 feet 4 inches—making in all the month, 17 feet 2 inches; and being below high water mark 22 feet 10 inches.

*September*—Red River fell since the 1st of this month, 1 foot 4 inches; fell previously, 22 feet 10 inches; and is now below high water mark, 24 feet 2 inches.

**Steamboat Safety Apparatus.**—That the explosion of steam boilers often arises from an insufficiency of water therein is a fact too well established to admit of a doubt. Much ingenuity has been displayed in the various methods that have been suggested for giving early notice to the engineer and firemen whenever the water gets too low in a boiler. A sketch of a plan has been handed in to us by Mr. E. White, of this city; we submit it for the consideration of those more competent to decide on its merits and practicability than we pretend to be. Its cheapness and simplicity of structure are strong recommendations in its favor. This

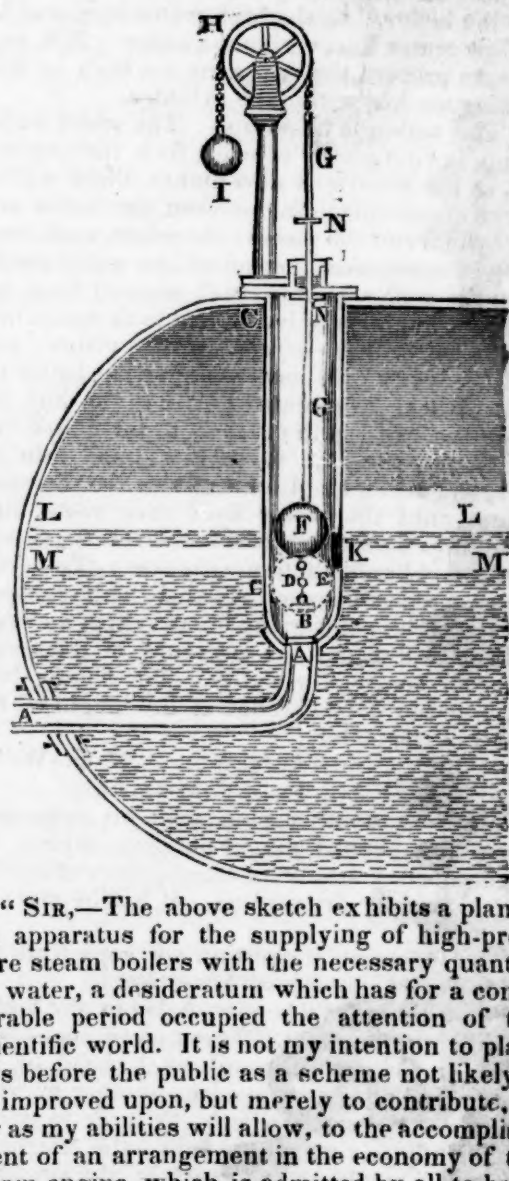



apparatus, denominated a *Tell-tale*, consists of a sheet iron or copper pipe, of about two to three inches diameter, marked in the drawing, F, closed at both ends, and attached in an upright position to the head of the boiler, A, and communicating therewith by the lateral connecting pipes, B B. The upright pipe having within it a floating metal ball, D, to which the valve rod E is attached. On the end of this rod is formed a papal valve, having its seat in the underside of the head of the pipe at C. H is a guide to keep the rod in its true position. It is apparent that the water in the pipe will always be on a level with that in the boiler, and that as long as the water in the boiler is kept to the water line G, the floating ball will prevent the valve rod from leaving its seat, but on a fall of the water below a certain line, will also cause the float to fall, by which the valve will be opened, and the escape of steam will address itself to the *ears* of those intrusted with its management.

At the Franklin Institute, in Philadelphia, experiments are making, under the superintendance of Mr. Johnson, (who was appointed by a vote of Congress,) to increase the safety and certainty of steam boilers. All that is known at present of the result of their labors will be found at page 30, Vol. II, of this Magazine. Every friend of humanity must most heartily wish that their exertions may be successful, and if any of the suggestions on the subject elicited from our correspondents, now or at any future time, should in any way be of use to them, we shall be gratified; in the mean time we would call the attention of some of our legislators to the following fact:

"In England, every boiler of a steamboat is required by law to be tested quarterly, at three times the strength it is licensed to use. The safety valve is inaccessible to all except the officers of the government. Mark the result—since the regulation was adopted, ***not a steamboat explosion has happened.***"

We have in the pages of this Magazine alluded more than once to this subject; descriptions and drawings of other plans will be found at page 153, Vol. I, and at pages 12 and 20 of Vol. II. It is occupying the attention of scientific persons of all descriptions. As it is a matter of the first importance, we shall introduce several other suggestions which have come under our notice; the first we extract from the London Mechanics' Magazine of May last.




"Sir,—The above sketch exhibits a plan of an apparatus for the supplying of high-pressure steam boilers with the necessary quantity of water, a desideratum which has for a considerable period occupied the attention of the scientific world. It is not my intention to place this before the public as a scheme not likely to be improved upon, but merely to contribute, as far as my abilities will allow, to the accomplishment of an arrangement in the economy of the steam engine, which is admitted by all to be of paramount importance.

"A represents the feeding pipe coming from the small water pump of the engine, which is made without a discharge valve. B, a valve placed at the bottom of the small cylinder, C,

answering to the discharge valve of the small water pump (before mentioned.) C, a cylinder, having the valve B ground into the bottom of it, and to which is attached the pipe A. D, a chain connecting the valve B with the metal ball F. E, a dotted circle, which represents the ball F when the water in the boiler is low. F, a metal ball shown in the position of the boiler being full; this ball is suspended to a thin rod, passing through the stuffing box in the top of the cylinder. G, a slender rod, to which the ball F is attached, and which has a small chain or cord passing over the pulley H to the counter-balance I. H, a pulley, and I, the counter-balance, to which the ball F and valve B are suspended. K, an oblong hole, about two inches long and one broad, to allow the water to pass from the cylinder C into the boiler. L, the high water line, and M, the low water line, within the boiler. N N, two keys, to prevent the rod going too high or descending too low within the cylinder.

"The action is as follows: The small water pump is continually at work from the engine; but, as the apparatus now stands, there will be a free communication between the boiler and the cylinder of the pump; therefore, each time the piston ascends, instead of the water rising from the well, a quantity will proceed from the boiler through the valve B, and back again into the boiler with the descent of the piston; nor will the water ever increase upon the boiler till it shall have evaporated down to the line M, when the ball F will descend to the dotted circle E, on which the valve B will fall into its seat, and act as the discharge valve to the small pump, until the water shall have risen high enough to float the metal ball F to its present position, when its action will cease. To adjust the counter-balance to the ball F, it should be of equal weight, subtracting the weight of an equal bulk of water, and the pressure of the steam upon the area of the rod G. The oblong hole is limited to the difference of the height of the water in the boiler.

"Yours, &c. E. F. W."

We have another plan with an engraviog from the West-Point Foundry, which we are compelled to omit, in consequence of having lost part of the description. It will be given in our next.

The following suggestion we copy from the New-York Commercial Advertiser:

"Let three bells be suspended in the boiler, of different tones, at different elevations—let a wire or rod pass through each head of the boiler, and after a convenient number of revolutions of the water-wheels, be made to twitch sufficiently to ring all the bells—the height of the water would be indicated by the sound of each bell—the highest bell should be above the surface of the water when the proper quantity is in the boiler—the sound of this, in such case, would always be clear; and if too much water in the boiler, the sound would be deadened, because the bell would be covered with water; and when the water was too low, that and the next bell below would sound clear; and if then it should be found that the supply-pump or pipe were out of order, the fire should be dropped out of the grate. This may be effected by constructing the grate so that it would be suspended on one side upon joints or hinges, and sustained on the other side by chains attached to a lever, which could be released or let go in an instant, and all the fuel thus dropped into the water without a moment's delay.

"It is obvious that all the passengers would be apprised of the danger, and the engineer put up to attention."

From the Rockland Advertiser, we copy the following pertinent remarks of Mr. Wm. Jones, of Haverstraw:

"To prevent explosions, nothing more is necessary than have proper *safety-valves* to regulate the pressure of steam the engine should work at, and regulate the water in the boilers, which should be done as follows:

"In the first place, no condensing engine should be allowed to carry more steam than 14 pounds to the inch, and should be regulated to this by having *two safety-valves* to each boiler, independent of the one of which the engineer has the care. These two valves should be weighted properly, as above named, *inside the boiler*, and may be put at a little distance from each other, over which a cast or wrought iron box, pierced with sufficient holes, of about an inch in diameter, to allow the steam to escape, should be screwed on to the boiler *with the nuts inside*, so that they could not be got at by any person except when the boilers are not in use. The reason why *two* safety-valves should be used is, that something may cause one not to act, although in upwards of twenty-five years' practice I have never known such a thing to occur. The steam-gauge should likewise be put in the most conspicuous place for the engineer and engine-tender to see at what pressure the steam is in the boilers, in case something may cause the valves to be inactive, which is almost impossible.

"It is also necessary that the water in the boilers should be regulated, so that the engineer and engine tender should know when there is too little in them, as many boilers have burst for want of a proper quantity. To prevent this, a valve should be placed on all boilers with *a float inside*, which will follow the water as it fluctuates. In this valve a whistle should be placed, that will give notice the moment the water is getting too low in the boiler, so that the engineer and all persons belonging to the boat will know the water is getting short, as it will continue whistling till the water gets to its proper quantity.

"Many persons may say, all boilers have safety-valves, and cocks to regulate the water in the boiler. I admit it. In the first place, however, the safety-valve on the top is a lever, exposed to the engine-tender or any other per-

son, who may go and remove the weight to any place he chooses, which I have seen done to crowd the engine with steam to no purpose except a bad one, and at a time when the piston has wanted packing, or the air pump, and at times when the valves have not worked regularly. In the next place, there are cocks to tell the height of the water. These cocks will not tell when the water is too low, without the aid of the engineer or engine-tender; nothing in this case can be equal to a self-acting machine. The whistle at all times will give notice of the water being too low, and the safety-valves blow off the steam when there is too much, when landing passengers, and at all times when there is too great a pressure in the boilers. In fact, no engine is complete without them; and it would be well for the Legislature to take cognizance of the subject, and pass a law, not permitting any boat to go on the water, unless fitted with these two means of safety. These two things being done, which would cost but a few dollars, would prevent the dreadful accidents that have of late so often happened, and save a great number of lives."

The following plan for preventing injury to passengers from the explosion of boilers of steamboats, suggested by Dr. Hare, is copied from the Philadelphia National Gazette:

"The boilers are to be situated either outside of the hull, of which the timbers for a sufficient distance are to be carried up as in a double decker, or otherwise they are to be situated as near as possible to the outside, in a niche or chamber made for the purpose. If a niche be deemed preferable, between the boilers and the interior of the steamer it is proposed to have a strong partition made water tight. In either case, towards the water, and fore and aft, there should be a frame and weather boarding, having no more strength than necessary as a defence against the rain, wind, and waves. This framing should be arched, or convex outwards with hinges, so that a pressure from the outside may tend to fasten it, while to a pressure from within it may offer a resistance comparatively slight. Doors for closing the passages between the niche and the deck might be similarly contrived, so as to shut like valves in case of an explosion.

"It is presumed that in all cases of explosion, the projectile power will be most exerted in those directions in which there is least resistance. It is only on this principle that it can be safe to fire a gun—the bullet yields, while the breech-pin is undisturbed. Before the bulwark between the boiler and the interior of the boat would give way, the external defences of the space occupied by the boiler, and even the boiler itself, would go overboard. Neither the steam, the scalding water, nor the fragments, could reach the passengers.

"It is conceived that the effect of the deck in protecting those who were in the lower cabins on board of the steamboat New-England, at the period of the late catastrophe, sufficiently demonstrates the security which may be afforded by a stout bulwark."

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Curious Clock.—The most curious thing in the cathedral of Lubeck is a clock of singular construction, and very high antiquity. It is calculated to answer astronomical purposes, representing the places of the sun and moon in the ecliptic, the moon's age, a perpetual almanac, and many other contrivances. The clock, as an inscription sets forth, was placed in the church upon Candlemas-day in 1405. Over the face of it appears an image of our Saviour, and on either side of the image are folding doors, so constructed as to fly open every day when the clock strikes twelve. At this hour, a set of figures representing the twelve apostles come out from the door on the left hand of the image, and pass by in review before it, each figure making its obeisance by bowing as it passes that of our Saviour, and afterwards entering the doors on the right hand. When the procession terminates, the doors close.—[Clarke's Travels in Scandinavia.]

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Improved Railway.—We have been favored with a sight of the model of a new mode of railway conveyance, which, if brought into use, will present extraordinary advantages to the public. It is on the principle of the Saxton locomotive pulley, and according to the calculations of the projector, who is an engineer of some celebrity, the average rate of travelling will be nearly thirty miles an hour on a light railway laid upon the ordinary road, without requiring the least expenditure for levelling, so that the cost per mile, instead of being £200,000, as it is on the railways now in use, will be only £5000. According to the proposed plan, a horse, walking at the rate of 2 miles an hour over a distance of only one hundred yards, will be able to draw a light carriage, containing four persons, a distance of more than 1,600 yards in the same period of time as that occupied by the animal in performing its own distance. The carriage, on arriving at the end of a mile, will be carried by mechanism from the truck on which it is placed to another truck in waiting to receive it, and the same will be done from mile to mile to the end of the journey, each succeeding carriage being drawn in a manner similar to the first, until the whole train shall have passed over the railway.—[London paper.]

# AN ADDRESS

*Delivered before the American Institute, in the city of New-York, October 17, 1833, by* JOHN P. KENNEDY, *of Baltimore, Md.*

MR. PRESIDENT, AND GENTLEMEN OF THE INSTITUTE:

Partaking with you in that concern for the promotion of the useful arts, which has induced the formation of this society, it is with a grateful alacrity that I have repaired to this city to discharge the duty which your appointment has assigned to me; and I would pray you to believe, that it is not in the conventional and unfelt form of speech of a common-place occasion I acknowledge the unmerited honor you have conferred upon me, by the invitation which has summoned me hither. I feel proud to be accounted a fellow-laborer with you in your cause,—the cause of our common country: and I am sincerely anxious, at all times, to contribute whatever may be in my power to draw upon it the earnest and favorable regard of our countrymen.

Your society, gentlemen, has already won a distinguished place in the respect of the nation: it has set a noble example of intelligent devotion to the public good: it has enlisted the aid of the purest patriots: it is fortified by the possession of the most useful talents; and it is cheered in its career by the applause of the best citizens. With such objects and means, and with such steadiness in the pursuit and employment of them, the impression which it is likely to make upon the common welfare cannot but confer a lasting renown upon this Institute, and furnish abundant reason for self-gratulation to its members.

Although I do not appear here, gentlemen, formally authorized to speak the sentiments of the population amongst whom I reside, yet I feel happy to be able to assure you, that you have their sympathy warmly excited in the success of your enterprise: that they hail you as comrades in the van of a glorious march: that they admire your zeal, commend your endeavors, and send you a cheerful and hearty "God speed you" in your effort to reach the point toward which you hold your way.

Coming from amongst a community where such feelings are rife, I can scarcely allow myself to be considered a stranger in this hall: and yet I am loth to part with a name that has brought me into the enjoyment of that hospitality which it is the characteristic virtue of this generous city to extend to those who put forward the stranger's claim. When all things else are forgotten by me, I will not forget the kindness by which I have been made to feel, that, in leaving my own home and visiting yours, I have only changed one circle of friends for another, not less endued with the qualities to attract esteem and take a place in the memory of the heart.

I have said, gentlemen, that your cause was the cause of the country. It is conspicuously so. It is your aim to wake up the slumbering strength of this New World, and to teach the philosophy by which a young and robust nation shall mount high above all competitors in its ascent towards a durable greatness. You have planned a wise and well-ordered scheme, by which the intelligence of our country shall thoughtfully direct the application of labor to happy and profitable results; a scheme by which experience may be garnered up in a safe depository, and thence be administered through such channels as shall convey it to the seats of industry, and pour it forth as a wholesome nutriment to make the genius of the nation sturdy—even as a great river distributed through innumerable outlets over a rich garden, irrigating the parched soil, causing every germ to fructify and every plant to flourish. You are concerned in the investigation of those sources of wealth which lie below the surface of ordinary observation: which are locked up in the secret chambers of science, or which are of so minute and subtle a nature as to escape the unlearned perception of the busy crowd around you. You stimulate new experiments by rewards; you invite labor into paths that it has yet left unoccupied, by throwing before it the results of the efforts of other nations in the same field, and you gradually infuse into the public mind a desire to seek out the means of giving scope to all that energy which indolence or the want of knowledge has heretofore kept without a motive to action. Such a design, skilfully pursued, is fraught with benefactions, which, day by day, become more

apparent in the history of the present generation, and which will incalculably enhance the comfort of the next.

It is no inconsiderable feature in this scheme, that it furnishes, through the instrumentality of an annual fair, an exhibition of the productions of American skill and industry in the various departments of mechanical employment. The ingenious and enterprising classes of our fellow-citizens who are engaged in the construction of the innumerable fabrics which administer to the wants and the luxuries of society, are invited to send into your hall specimens of the several commodities with which their labor has been conversant; an impulse is given to the desire to render this exhibition as various as possible, by the offer of honorary premiums for excellence in the most useful and important branches of handicraft; emulation is excited to increase the list of serviceable inventions; and humble and retiring genius is persuasively solicited to come forward into the circle of active notoriety, and to throw in its contributions to the wealth and renown of the nation.

This invitation has been met, on the present occasion, with the most commendable spirit by those to whom it was addressed, and the result has been what,—speaking from the impression made upon myself,—I may appropriately call a dazzling display of the rich and rare creations of mechanical skill. In your exhibition room has been presented to the inspection of the eager and thronging multitude, whom zeal and curiosity have attracted to the place, an array of the products of art, of which it is not too much to affirm that, for excellence of workmanship, beauty in the design, genius in the invention, or variety in the kind, may challenge competition with the works of any equal number of artisans in the most elaborately trained and dexterous community upon the face of the globe. The eye wanders with delight over these evidences of the ingenuity of our countrymen, and the heart of every friend to the enduring welfare of this land beats high with the inspiring hopes which such a scene conjures up to his fancy. There are the elements of present and future glory; there the promise of comfort, wealth, and enjoyment; there the material from which, I trust, for many an age to come, the sinewy toil of a sturdy, independent, and intelligent people may earn them competence, strength, and virtue, and, through these means, continue to the world that most glorious of its empires,—a free republic unerringly converting to the best use the talents with which God has endowed it, and mastering the most hidden as well as the most open resources of a territory as exhaustless in moral and physical treasures, as it is wide in its expanse.

This show is but an epitome of the vast and complicated aggregate of national work. Various, rich, and beautiful as it is, it offers specimens of scarce a tithe of the different species of crafts which occupy our busy population. The thousand branches of the great Cyclopean labor of the forges are, of necessity, but inadequately represented; the almost infinite departments of toil in the shaping of wood; the master art employed in the building of ships; the endless forms of expert joinery; the grand and the beautiful in architecture; the countless fabrications of the metalic and mineral stores of nature,—are all of a kind to defy their full exhibition in your hall: and the observation of all men will suggest to them that, of the diversified inventions which daily necessity provokes, which pervade all the pathways of human use and subserviency, and which incessantly engross the thoughts and care of our eager and restless craftsmen, it would be vain to expect more than a faint image or symbol there: no single structure of this capacious metropolis possesses dimensions ample enough for their display. Yet such as we have seen it, this exhibition may properly be denominated a miniature of the whole,—a card of samples taken from the great storehouse of our country. The minute figure or impress of the whole body may be absent, but the genius that makes the mighty mass is present; the moral essence is present; and there may the patriot citizen take his children, and, from that volume, read them the lesson that shall teach them to be proud of their country, to love it, and, in after times, to pursue its good. I could wish that the traveller from other climes, whether his intent be "wicked or charitable," whether he comes clothed with prejudice as a garment, or appear in the pure robe of philosophy, should have the fortune to witness such a scene as has fallen under our eyes; it would teach him that the glory of America is not to be measured by the finical pretensions of the drawing room, nor by the custom of conviviality at the table, nor yet by the scale of comfort and accommodation at the inn;—but chiefly, and most adequately, by the great intrinsic vigor of our working people, and by that incalculably elastic spring that heaves up the inward vital power to the surface, and transmutes the

gross elements of earth into things of value—that makes the poor man the being only of a season, the rich man the sure inheritor of increasing luxuries, and the whole nation the abode of happy and prospering citizens.

It will not be out of place, nor unexpected on an occasion like this, to inquire what has given existence to these multitudinous products of the work of hands: whether they have sprung from the mere natural and unsolicited impulses of our population, or, on the contrary, have been called into being by a course of nurture on the part of the government?—Whether they are objects worthy to be cherished by legislative care, or owe their prosperity to a system of partial policy, which, while it may enrich a small portion of our fellow-citizens, does so only by the impoverishment of the great majority, or indeed of any part of the nation?—Whether it is wholesome in the administration of the concerns of our country to establish, protect, and preserve a capacity and an interest to follow these pursuits, or, on the other hand, to leave them to the unaided instinct which belongs to thrift, and to the tendency of individual effort to employ itself upon the most profitable enterprise?

These are questions of serious import, and have long occupied the best minds both in this country and abroad. They relate to the welfare of the whole state, and concern the present race of Americans as deeply as any topics affecting their national destiny—yet not less deeply than they concern all after generations in this republic. It is my purpose to claim your attention to these questions:—the time and place are appropriated to the inquiry, and the subject itself derives light from every endeavor to carry it into the reflections of our people. I promise myself and the cause, the advantage, at least, of once more engaging you to employ your minds in its investigation.

It is now about ten years since the legislature of the Union gave its first indication of a settled purpose to incorporate into the public policy that system of measures regarding the expansion and support of domestic industry, which has since been the cause of so much excitement throughout this country. The thoughts of the people of the United States had, for some years previous, been tending to this point; and some laws referring to it,—which were rather the forecast shadows of the system than the adoption of the system itself,—had, it is true, been passed by Congress; but, until the period to which I have referred, it could scarcely be said that this code for the maintenance of domestic labor was resolved upon as a permanent measure of legislation. Accordingly, in the year 1824, a decisive tariff law, constructed with a view to the encouragement and protection of home manufactures against foreign competition, after full and free discussion, was enrolled in the statute book.

It is well to pause at intervals and look back upon our career, that we may compare fact with philosophy,—performance with promise. He who does so upon the last ten years, will find much to occupy his thoughts and instruct his mind. I will not pretend to draw even an outline of this survey as it strikes my view: time would not serve me to array the vicissitudes of opinion and the developements of history that belong to such a labor; but I will ask you to note the most prominent feature in the whole picture, and almost the only one which, throughout that period, has been without variation,—I mean the steady, onward march of the nation from one stage of good fortune to another; its career upon a plane of continued elevation. I would ask you to mark, too, the enchanting prospect from its present height. You will look over a landscape gilded with the purest sunshine, in an atmosphere redolent with fragrance: you will see how content has shed its balm upon the people; and how healthfully labor has walked to its toil. You will hear the frequent stroke of the woodman's axe, sending its dull echo through the frontier forest; and perceive the rich uncovered earth turned up to the sun, over many a former waste and distant wild. You will find huts grown into comfortable houses, hamlets into villages, villages into cities, and cities into great and gorgeous marts. Canals and roads may be seen stretching forth their serpent lines into the bosom of the remote vallies: fossils more rich than gold, will be found to have been dug up in abundance from the dark chambers of a thousand mines: the smoke of unnumbered furnaces will be discerned rising above the screen of the great wilderness; flocks infinite will be seen whitening the summits of the interior hills; and, on the Atlantic, commerce redoubling her busy fleets. The sound of the hammer, the din of the shuttle, and the clamor of the mill, have made the universal air vocal; and every where the incessant murmur and gush of business tells of a generation intent upon aggrandizing a vast and scattered empire, which now, like a strong man, "walks on its way rejoicing."

This is the picture afforded by the retrospect of ten years, and its hues are the more brilliant because they are warmed (to use the painter's phrase,) by their contrast with the scene presented in the previous interval of the same duration. Of that interval, embracing the space from the conclusion of the war until the era of the tariff, but a melancholy account can be rendered. Its unhappy prominent points may be shortly enumerated in a concise story of disappointed hopes and fruitless endeavors. It began with a hollow and unreal show of vigor in trade; an unnatural animation pervaded the departments of enterprise, more like the quickly exhausting fire of a fever, than the wholesome glow of health; —and the end was marked by deep disaster and pervading bankruptcy. Between these extremes we successively saw the evils of a depreciated currency, a sated commerce, and an overthrown industry. Our sturdiest population mourned their fate in sackcloth and ashes, and our best and most active citizens were whelmed in all the horrors of poverty.

A philosophical statesman would dwell with intense interest upon these pictures, and he would ask what wrought that marvellous change which made the first so beautiful? The reply would be,—that necessity is the parent of wisdom, and national instinct is not less strong than individual: want and privation are not the categories in which man is likely to repose; the restless desire to attain to good will make him astute in his perception, active and incessant in his toil; and the pressure of difficulty, better than all other masters, will teach him the true philosophy. These were the influences which produced the change, and the infallibility of their action was signally manifested in the sagacity with which the American people betook themselves to the most certain, and perhaps the only cure for the evils that encompassed them,—the adoption, namely, of the AMERICAN SYSTEM.

At the period of the adoption of this system, the reflecting portion of the citizens of the United States were divided by two theories in regard to the promotion and preservation of domestic prosperity; and time, although it may have softened the asperity of the collisions of opinion, has even yet failed to produce unanimity: many acute and learned minds are still to be found in the ranks of both. I allude to the advocates of the commercial system, or, as it is more familiarly known, the free trade theory, on the one hand, and to those, on the other, who defend the policy which supposes it wise to encourage and promote domestic industry by restraints upon importation. The majority of the nation coincided with the latter; and we may indulge the hope, that, as experience grows apace, and passion subsides,—as the fell spirit of party is lulled asleep, and good men, on either side, cultivate a conciliatory temper towards each other, the day is not far off when we shall

> "In mutual, well-beseeming ranks,
> March all one way."—

So far, indeed, is that happy anticipation now realized, that we may discuss the topic with reciprocal good will, and express our several opinions, free from the dread of personal exasperation or unkind surmise.

The free trade theory is of modern origin. It dates no further back than the middle of the last century, and from that time until the present it has been, in the land of its birth, a mere speculation. It is profitable to study its history and character amongst those to whom it owes its existence. I hope, by such an examination, to show that it is misunderstood in our country, and is quite inapplicable to our circumstances.

In Great Britain and in France, where the discussion of this doctrine has been most animated, it owes its popularity to a condition of things of which we have no parallel. In the first of those nations especially, (and in a not much inferior degree in the latter,) the whole machinery of municipal organization is curiously artificial. Government is complicated by an elaborate division of ranks and orders, which hold antagonist positions to each other, rendering the lower portions painfully subservient to the interests of the upper. Wealth is there distributed rather in lakes than rivers, and these large reservoirs are perpetually attracting to themselves the smaller accumulations, gathering

> "their sum of more
> To that which had too much."

Taxes without stint, the price of all their power, bear with a grievous weight upon the body of the community, and the constant strife has been each man to shift them for himself upon his neighbor, like an uneasy burden, which, in this world, the crafty ever compel the weak and foolish to bear. In this struggle power and wealth have gained the vic-

tory; and the huge machine has become, at last, a marvellous piece of intricate joinery, whose springs are so ingeniously contrived as to throw its weight upon the inferior masses, whilst, from the implicitness of the mechanism, none but the eye of a skilful master could perceive the series of actions by which this result is obtained. Such an eye was found in the acute and accomplished political economists both of England and France, when they came forth to denounce the injustice of the ancient systems of internal government. They saw in the monopolies and exclusive privileges which belonged to every guild; in the restraints that broke up or averted all competition in labor; and in the vicious circle of secret taxation, the hateful principle which gave permanency to vested wealth, at the expense of all liberal enterprise. It was, in their view, nothing better than a contention, on the part of the rich, to increase their store, by entailing the curse of perpetual poverty on all the rest. It was, emphatically, a struggle to preserve descriptive immunities from the encroachments of the large mass of the laboring classes. And hence arose that war of opinion which has so long raged in these nations between the two orders of the state. The assailing party called theirs the cause of free trade; whilst those on the defence were denominated the advocates of restriction.

We may stop here to inquire, what was the aim of those who displayed the banner of free trade? Was it to shut up the workshops, dismiss the laborer from his loom, and send him to the tillage of the earth?—to destroy the manufactories, and arrest, at once, all the branches of mechanical occupation?—or was it to render this species of employment more profitable to the workman who gained his bread by it?—to give him a better demand for his products, and better recompense for the fabrication of them? These queries are fully answered by one of the most profound and thoughtful of the statesmen of Great Britain, himself an authoritative leader in the van of the cause of free trade—I mean the late Mr. Huskisson, to whose memory it is due to say (and it may be said with less suspicion of interested panegyric on this side of the Atlantic), that no man understood the question better, or moved towards the accomplishment of his country's glory with a more erect, earnest, or learned spirit. I wish the occasion allowed me time to make good what I am about to say, by reading extracts from that gentleman's frequent speeches upon these questions in parliament. I invoke your study of these speeches: to my apprehension they are full of political wisdom and salutary thought. His free trade, with little abatement, is our system of duties: his doctrines, allowing for the difference of the condition of the two nations, are the doctrines we teach; and had it been his lot to have been an American citizen, he must, in accordance with his own fundamental principles, have been the friend of our domestic industry. We are to judge of theories, not by the detail necessary to develope them—for that will vary with times and places,—but by the great results at which they aim. The theory of this British champion of free trade, as I read and understand it, is to maintain, encourage, and protect, without compromise or reservation, to their fullest extent and amplest expansion, every manufacture of Great Britain for which that nation has a capacity;—emphatically to protect them by duties that shall exclude foreign competition, without reference to the cheapness of supply at home. That sentiment breathes in every speech, is uppermost in every argument, and has taken the deepest hold, of all others, upon his public affections. And if, from other considerations, it fell into his plan to reduce the duties to a lower standard, it certainly never entered into his imagination to bring them below the point of ample protection to the staple labor of the nation, or to run the slightest hazard of destroying any prosperous manufacture. How far such a scope of policy falls within the comprehension of the friends of free trade in the United States, I leave you to judge.

It would indeed be an experiment of curious interest, to examine an intelligent advocate of the commercial system in England, upon the practical aim of his doctrine. I would imagine a case for such a man, and propound a question to him, from the answer to which I should hope to obtain a valuable illustration of his theory. "Let us suppose," I would ask, "that by some recent and extraordinary secret of art, America should be enabled to manufacture broad-cloths, cotton and hardware, at two-thirds of the cost for which they could be produced in Manchester and Birmingham,—does your doctrine of free trade require that, in such a case, you should allow the people of the United States to furnish you with these commodities?" I think he would answer, (I am sure the statesman to whom I have alluded would have so answered,) "Our free trade does not contemplate the idea of

having the home market supplied by foreigners: we have an anxious solicitude to preserve our own industry. You must not conclude because we have reduced the duties on cotton goods to ten per cent., on woollens to fifteen, and on linens to twenty-five, that it is our purpose to let in foreign importations. These rates were adopted under a conviction that they would amply protect our manufacture, whilst they would also guard it against deterioration: they serve to admonish our artisans of the necessity of care and skill in their employments. In no event could we consent to discharge these people from their present occupations. If we did so, we could give them no other employment. Even if our agriculture were not already over-supplied with labor, this population could not readily betake themselves to it, for want of knowledge of such affairs. Their only resource would be in emigration to America, where, (unless the people were led away by their notions of free trade,) they would be invited to set up vast rival establishments that would soon deprive us of all hope of regaining our lost ascendancy in commerce. Free trade with us is principally concerned in removing certain cumbersome restraints, which for centuries past have been growing up in the internal organization of our society, and now impede the full expansion of domestic labor. As to that part of it which belongs to foreign commerce, we are seated too firmly upon our immense piles of capital, and have too much confidence in our long established skill in the arts, to be afraid of any foreign rivalry: our faith in this position, however, would be changed by the extraordinary, and, what we deem, impossible accident imagined in your proposition. We should, of course, in such a contingency raise the duties to a higher standard."

If this should be the answer of the friend of free trade in Great Britain, wherein does it differ in principle from the doctrine upheld by the advocate of domestic industry in America? and how widely does it depart from the purpose contemplated by those who are for abolishing our duties! Yet, notwithstanding this essential difference in the relations of the two countries, the free trade theory at one time had acquired a degree of favor in the United States, that would probably have excited some surprise abroad, if its application here had been well understood. There were many intrinsic circumstances to give it popularity, and render this tendency of opinion natural to our citizens. The free trade advocates in England and France are identified with the leaders of popular reform; theirs is supposed to be the liberal side: they make war against ancient abuses: their principles are whig principles: they are the assailants of old and intrenched errors, with which are associated, in our minds, all that is distasteful in monarchy; and it is natural, therefore, that the citizens of the United States should find their sympathies enlisted in favor of this party. We constitutionally feel ourselves inclined to applaud the effort they are making, and thus are easily led to adopt the idea that the like system must produce the like result when exhibited in action at home. A more careful examination would show us, that whilst we partake of and encourage the same liberal concern for the interest of the industrious classes here, we are but little likely to promote their welfare by similar laws.

The best theories of political economy are those which are formed upon an experience of facts; the wider, the older, the more minute this experience, the nearer the approach to certainty. Of all nations now existing, to none is this condition so necessary as to the United States. No community has ever before grown up under the same circumstances; none was ever exposed to the influence of such contingencies; none was ever marched forward, at the same pace, through such diversified chances;—to none, therefore, is it so utterly unsafe to apply, without qualification, the theories which have been founded on the experience of European nations.

It is common to say that the schoolmaster is abroad; by which figure the idea is succinctly expressed, that men are more intent than formerly upon the improvement of the arts of life. The moral and physical qualities of mankind are more diffusely developed, and the light begins to fall upon the great mass. Science may not tower more high, nor genius, like the eagle in "the pride of place," hold a less solitary or sublime eminence; but the sun and the rain of useful knowledge, that make the moral world fruitful, and generate the stock of household virtues, shine and fall through a wider atmosphere: they visit the by-places and secret corners, and vivify the good seed within humbler enclosures than they were used to do of old. The world no longer creeps upon its way by slow and lazy steps, some half century apart, but, like an impatient courser, bounds towards its goal. It leaps from experiment to experiment with hot haste, as if time were too short, and eternity

too near. Science is made popular and common, and all classes seem to be busy to discard the old machine for the new. A peace of unusual duration, throughout Christendom, has assisted this process, and rendered the competition universal, eager and intense.

Just at such an era has it been the fortune of the United States, with scant forty years upon their annals, to be thrown upon their own resources. The peace of Europe had robbed us of the golden egg which our neutrality had yearly hatched; and the war which terminated in 1814 had left us—as all wars are apt to leave both victor and vanquished,—with nothing but our honor. In such a plight were we, for the first time, thrown upon our own resources, and called upon to play the game of nations. The arts we followed, and the prize we aimed at, were the arts and the prize also of Great Britain,—a stupendous power, of infinite wealth and long practised dexterity. England was unavoidably our rival; and, whether we would or no, it was our destiny to enter the lists with this giant, who, like him of old, bore a spear whose staff was as a weaver's beam, and stood in panoply, ready to encounter the young champion that came simply with his pebbles from the brook.

The control which Great Britain possessed over capital, population, and skill in the arts, confessedly placed her far above us in the means of sustaining the competition. It was in this relative condition of the two parties that the doctrines of free trade were so clamorously inculcated on the other side of the Atlantic. England had her manufactories established, and was then supplying a large portion of the world: she feared no inroad upon her domestic market, and her policy was to open all foreign ones to her trade. In no event could she be a loser by the policy;—in many particulars she had much to gain. A reciprocal reduction of duties upon manufactured fabrics would be but a harmless measure to her;—it would be thorough annihilation of manufactures with us. She had every motive of self interest to impel her to urge this measure upon foreign nations. There were, indeed, some few branches of her industry, of minor importance, which she had previously attempted to build up, though evidently disqualified by climate and position to maintain them:—an enlightened restrictive system does not pretend to foster pursuits incompatible with the capacities of the nation. Of this nature was the process of throwing silk;—a process manifestly unsuitable to the geographical position of England, and therefore hurtful to the silk weavers. The thrown silk was, to a certain extent, a raw material, which, for the interest of the larger manufacture of the woven fabric, it was better to import from France and Italy. The duties, therefore, were reduced upon this article, and, what is remarkable as an evidence of the supreme care of Great Britain for her domestic industry, amidst all this profession of free trade, the throwsters were compensated by the government for the destruction of their business. Such reforms were introduced with the intent, as I have before expressed it, to give the greatest attainable vigor to her home labor; to set up and corroborate her manufactures, rather than to pull them down; and to get rid of every useless restraint that bore upon the working classes. It was like the preparations of an expert seaman, making ready his ship for battle: the unserviceable lumber and dead weights were thrown overboard, and the crew rendered more efficient by lightening the bulk. Such was the practical exposition of English free trade, as we read it in the measures of the party who maintain it.

What was our condition at the commencement of this struggle? We had followed the pursuits of agriculture and commerce. For many years it so happened, owing to the influence of extraordinary causes, that our agriculture was profitable, and our commerce, therefore, prosperous. But the causes had now been removed, and both of these concerns began to decline. Foreign ports were better supplied from other quarters, and were now shut against us; agriculture was overburdened by redundant crops that could find no market; commerce was paralyzed by the drying up of the spring from which it derived its supply. The wealth of our soil rotted on the field where it grew: the working classes could find no wages: enterprize was disheartened: if it attempted to enter the field of mechanical labor, it had no skill, or if it had skill, it was certain to find a foreign manufacture in the market before it at a less price: it wanted encouragement from the government, and protection to insure it a recompense. It had no protection, and therefore it was afraid to venture. All through our system there was a horrid atrophy—a dull stagnation of the fluids. In our distress we looked to the example of England; changed our policy; betook ourselves to protected manufactures; and in that pursuit speedily found relief.

It is somewhat strange that, after this course of experience, the advocates of free trade should still insist that whatever appearance of prosperity there may be in the land, it is either illusory, or exists in despite of improvident legislation; and that they should now tell us all this manufacturing industry ought to be pulled down, and the country restored to a state of trade dependent singly upon the exchange of the fruits of husbandry for the fabrics of foreign nations. It is still more strange that they should call that course of labor *free*, which is constricted by foreign rivalry into one poor, unprofitable path, from which it dare not depart without utter ruin, and yet which it can only pursue through all the embarrassments of an overloaded and unrequited competition at home—a pathway clogged up with the unconsumed and unconsumable fruits of the earth. Labor never became truly free until the provident arm of the government lifted the weight from its shoulders that pressed it to the dust, and gave it space to expand and travel through all the ways and passages of an infinitely intersected nation.

I would like to engage your attention a little longer with the object and philosophy of free trade, as it is professed in this country. Its first purpose is to break up the manufacturing system. Let us suppose it successful;—it has then a dogma to the following effect:—"Although the manufacturers are broken up, labor will gain by the change, because it has now the choice of a pursuit more congenial to it—the cultivation of the earth." I will say nothing of the freedom of a choice without an alternative, but I will remark that agriculture may become overstocked and grow unprofitable; and, as this cannot be denied, I will inquire what, in that case, free trade prescribes? "You may then," reply our opponents, "go to manufactures: it is the natural impulse of labor, when one pursuit is rendered unprofitable by too much competition, to betake itself to another which offers a better reward." I will imagine that we have taken this advice, and have determined upon erecting manufactories because agriculture has ceased to make a valuable return for the labor employed upon it. First, it is obvious that we must have been reduced to a great deal of suffering before we could have brought ourselves to abandon the paternal acres: Secondly, we have to set about the education of a new generation of mechanics, and to teach them the difficult arts of handicraft, under all the disadvantages of having but few instructors, and an intricate lesson to learn; and, lastly, we have expensive establishments to build. We accordingly sell our farms at low prices, construct workshops and manufactories, import foreign artisans to teach our own, exhaust capital and credit in the undertaking, and, perhaps, in some three or four years, find ourselves ready to furnish the market with a commodity that shall be as cheap as the imported one. Just at this stage of our adventure we make an important discovery. It is this; that up to this period the imported fabric, similar to our domestic one, has heretofore been sold to the country at some fifty or hundred per cent. above its cost of production; and that the same is now offered twenty per cent. below the price that we require for our indemnification. Ascribing this fact, perhaps, to some temporary accident, we reduce wages and other expenses, and, foregoing our own profit, we diminish our price correspondently to that of the rival fabric. Straightway the foreign production comes down another twenty per cent., and another, if necessary, and we are now convinced that this abatement of price is to be regulated by the energy of our competition; until, in despair, with the horrors of bankruptcy before us, and the clamor of our disappointed artificers ringing in our ears, we are compelled to stop our work. All that we have gained by this unlucky experiment is the satisfaction of having furnished our own people a touchstone by which they may ascertain how much the foreign manufacturer has heretofore been extorting from the American consumer in the shape of large profits upon his merchandize. When matters have arrived at this ebb, we have recourse again to the advocate of free trade, that we may learn from him what remedy he proposes for the disaster we have suffered; thinking, perhaps, that he may recommend,—what we are now prepared to believe a very obvious relief,—a duty, on the part of the government, sufficient to keep the foreign article on a level with the domestic. This, however, he does not grant us—it is against his creed; but, in place of it, he gives us an apothegm,—"that that manufacture which is not able to support itself is not worth protecting by duty; and that which is, does not require it." From this, we conclude it is his opinion, that we have gone to the wrong manufacture; and as we inform him that all our neighbors are in the same predicament, it is now his counsel that we had all better go back to farming. We consequently dismiss our workmen, and send them

back to the plough, and to the labor of felling the wilderness; where, at least, they will have enough to eat, and where, if they find they have but little to wear, it will be attended with the consolation that the fashion of the forest does not require much foppery, and that every man's neighbor is about as poor as himself. We have now made our circuit, ending where we began; and upon casting up our account we find that we have travelled round this conjuring zodiac,—leaving an item of wealth behind us at each sign we passed through,—and have come out at the starting point completely stripped of all worldly possessions—gainers only in our knowledge of the experimental philosophy of free trade, and that "it is better to bear the ills we have, than fly to others that we know not of."

It is a point, however, much insisted upon, in recommendation of the free trade doctrine, that it furnishes the nation with its supplies of merchandize at much less cost than the domestic manufacture; and this fact is considered of sufficient importance to justify the abandonment of the opposite policy.

I will not affirm that, in any given branch of manufacture, we can furnish the fabric cheaper than the foreign manufacturer could do,—though such an assertion would be, doubtless, sustained, in regard to a large number of our products,—but I do affirm that our manufacture renders the foreign one cheaper, and that we get what we require at a much reduced price, by reason of the presence of our own workshops. It is not necessary to my present purpose that I should stop to discuss this principle; my object is to advance another proposition of far more importance, namely—that it is worthy of but little consideration, in the estimate of the value of our domestic system, whether the necessaries of life are rendered cheaper or dearer;—the country, we say, is benefitted to an incalculable extent, by being made the theatre of manufactures.

If it were true, as it has been affirmed by the opponents of the present policy of the government, (which, nevertheless, we deny,) that the duties levied for the encouragement and protection of our own labor were an actual tax upon the people, to the full amount of the excess above the ordinary demand for revenue, still the nation at large derives such advantages from the system as to vindicate the expediency of the tax. If, of the twenty millions raised in revenue, one half, or even the whole, were a tax of protection, it is an inconsiderable burden when compared with the wealth it creates and scatters over the land.

It may be said, that of the nine millions of free inhabitants of the United States, at least four millions, including both sexes, owe their livelihood, in whole or in part, to the work of their hands, and, in some shape or other, receive wages for their labor. The presence of manufactures has had the tendency, as all men admit and as the history of the country proves, to raise the wages of labor. It is setting it down at a low estimate,—much, in my judgment, below the fact,—to compute this increase of wages upon the whole mass of labor, agricultural as well as mechanical, at an average of six cents a day. Yet this sum would give an amount of seventy-two millions of dollars a year of increased wages, distributed amongst the working people of the United States by the operation of the domestic system: thus adding immediately to their comforts, and the improvement of their condition. Far beyond this money computation is the nation benefitted in other forms: a large number of idle hands are provided with employment; new fabrics, before unknown in our list of conveniences and luxuries, are brought into existence, and introduced to common use; industrious and thrifty habits are inculcated; the morals of the people are elevated; education diffused; trade and commerce greatly extended, both by the vast accumulation of commodities for exportation, and by the capacity for a higher scale of living, and for the consumption of a greater amount of foreign productions, communicated to the laboring population: a thousand new springs of wealth are set in motion, that swell up the sum of national prosperity much beyond our powers of calculation. Value is given to the productions of the forest, the field, and the mine, on our remotest frontier: internal improvements, necessary to facilitate the carriage of these productions to market, are rapidly extended, with instant remuneration for the cost of construction. The hunter, accustomed to waste half of his life in idleness upon the sunny hill-side, or to gather a precarious and scanty support from the desultory pursuit of game, is converted into a feeder of sheep, or the proprietor of a thriving mill; our most distant population are linked together by the bonds of internal commerce; the common inheritance of American citizens is rendered more valuable, by the vast increase of towns, roads, public works, fortifications, and navies; and, dearer than all, our UNION is corroborated, cherished, and perpetuated in the affec-

tions and the interests of the people. All this is achieved by a *tax* (if our opponents will have it so,) of some ten or twenty millions of dollars. Surely never was tax so recommended and consecrated by the virtue of its purpose!

It is obviously no answer to this argument to say that the seventy-two millions given in increased wages are still a burden upon the rest of the community; for, in regard to that sum, no consumer pays it without getting an equivalent in the immediate article he purchases: and it will also be observed that the mass of consumers is made up, in great part, by the workmen themselves.

Free trade would have us relinquish all these advantages. It would drive us to the meagre resort of household manufacture, and to the labors of the field; or it would compel that industrious, vigorous, and stirring population, who now inhabit the northern, western, and middle sections of this Union, to crowd into the pursuits of southern agriculture, until that region was also overstocked with labor and suffered the same plethora of production which heretofore befel the grain-growing states. It would dry up the sources of all prosperity but these, and the scant commerce that would be employed in the only export trade it left us. In a brief space, it would no less surely destroy the profits of planting and the foreign commerce that depended upon them; u i il late, and after a long interval of decline, it inevitably and irresistibly ended in the adoption of a system of restriction,—the only permanent resource of this country.

It is not wonderful that a theory which so ill supplies the emergency of the times, should be rejected by the majority of our people,—especially, by the laboring majority; nor is it to be expected that, with the results of the opposite system before their eyes, the nation would soon consent to forego the evident advantages they derive from it. However much captivated by the seeming liberality and reasonableness of free trade, many intelligent citizens of this country may have been, whilst the subject was yet new and unaided by experience, it has lost its lustre and its fascination now. The public mind has been called to regard the peculiar position of the nation in reference to this subject, and it has observed how singularly the system, as applied here, has cheated us of the blessings it promised abroad; that public mind has, therefore, turned with a steady and rapid momentum, into the adverse current which, we may assuredly believe, no future state of things will ever long disturb.

Our country is a country of busy men. Whatever gives facility and expansion to labor, benefits every class of the community. Unlike the European states, we have no piles of hoarded wealth destined to be transmitted in mass to our posterity. Opulence, amongst us, is a gilded pyramid that stands upon a pedestal of ice, and its foundations are perpetually melting in the sun:—the stream that flows from them may fertilize the land, and may spread bloom and beauty over barren places; but the pyramid itself falls in its appointed time, to be built up again by other hands and to adorn other sites. Our laws, which forbid the accumulations of hereditary treasure, have reiterated to the American citizen that "sad sentence of an ancient date,"—that, "like an emmet he must ever moil,"—and they have promised to labor fullness of honors. In providing, therefore, for the prosperity of industry, we but hew out for ourselves and our posterity a better and more auspicious destiny. The stranger, who comes to spy into our land, comes but ill furnished to read the deep spirit of our institutions, and to see the workings of our political mechanism, if he have no eye but for the conventional refinement of exclusive and aristocratic society. To him all things will seem vulgar, and it will be so written in his diary. But if he would learn what makes us a peculiar people; what gives us strength and efficacy as a nation; what makes us happy and united; and, above all, what is to make us a permanent, massive, and predominating power in the affairs of the world, he will find it in the principle that has ordained the lot of one to be the lot of all,—the principle that rejects the very exclusiveness he values, and renders all observances, customs, immunities, rights and aspirations, common, or,—what in his vocabulary is the same thing,—vulgar. When the subject of crowned kings shall arrive at the philosophy and the temper to see these things, he will cease to report "that all is barren from Dan to Beersheba," and he will find less annoyance to his cloyed and dainty appetites as he traverses the broad expanse of our republican empire.

It is a beautiful problem to study in this country the great and immediate interest which, as a nation, urges us to the melioration of the condition of the working classes.

Every improvement which they experience is instantly national: they are the people; their suffrage elects, their will determines, their power directs and executes. Give them education, competence, affluence, and straightway you give to the nation intelligence, vigor, and virtue; depress them, and you sink the national character by the first touch of the spring. The improvement of the arts in America is one of the marvels in the history of mankind. In fifty years we have sprung up into the maturity which other nations have not found in centuries; and in that brief time have won the honor of attracting the jealousy and alarming the self love of the master states of the world. Our institutions are scanned, our policy watched, our opinions measured, and our growth noted by all nations, with an eager and sleepless assiduity, that, to such of us as are unconscious of our stature, seems scarcely commensurate with the relations we occupy in the family of mankind:—we hardly persuade ourselves that such a scrutiny could be suggested by other than a frivolous malice. No small share of this consideration is derived from the energy with which our population have arisen to excellence in the arts; and we are thereby admonished, as we value present and future renown, to extend over this characteristic endowment our most cautious and friendly solicitude.

It is not too much to say that the preservation of this character depends, in a very important degree, upon the policy of our government. It is a fatal error to believe that the interests of the community are always best consulted when left to the unassisted suggestions and instincts of individual foresight. It is unmeaning cant—nay, worse—it is pernicious heresy to defend what is called the "let-us-alone" policy in the affairs of nations. Individual astuteness may be a safe guide in individual concerns; but it will never shape or control the circumstances of the state; nor will it ever select—because it has neither the insight, nor the power for such selection—the series of predicaments most opportune to the employment of personal capacities. The great connexions of public affairs are only to be managed by state policy; and it must ever be a question of grave debate what scheme of policy, in every case, is best adapted to the display of the inheritant and appropriate vigor of the individuals who compose the state. Man confined in a prison may safely be trusted to his instincts to make the best of his condition; but the question of his release or further confinement will be determined by the power above him: so, in regard to the narrow circle in which he works in society,—that may be expanded or diversified by the care of his rulers. All government is instituted for the consideration of such questions: it is provided with powers to sway individual appetencies, to suppress such as are hurtful, to furnish occasion for such as are good, to remove obstacles that stand in the way of happiness, and to invent or contrive relations which shall give the amplest scope to the successful exercise of the useful faculties. This is accomplished by protecting that which is weak or immature; defending that which is valuable; enlarging that which is confined, when its tendency is good; and suppressing that which is mischievous.

It was under a conviction of the efficacy of these principles that the majority of the American people called for legislative aid against the evils which befel them some twelve or fourteen years ago. They said to the government, "Let domestic industry thrive; and give it room to thrive, by taking off from it that dead weight of foreign competition which disables enterprize, and turns all our currents of action into one straitened and unfruitful channel." This fiat produced the system of restriction upon the importation of all such commodities as it was supposed we had a capacity to manufacture at home. The merits of this system, even now, after trial, have, in certain portions of our union, been doubted, denied, and condemned. Its opponents, however, I believe, nowhere refuse to admit that, to the large numerical majority of the people of the United States, it has brought the good it promised. The objection to it is founded mainly on the consideration that it does not act with the same propitious influence upon that industry which is concerned in planting. I certainly do not mean now, after the ample discussion which this question has received from the best informed minds of our country, to repeat the arguments with which this objection has been met and refuted. I might find abundant facts to sustain these arguments in the late experience of the dissenting portion of our population themselves: I might, in this experience, confirm and fortify all that has been advanced in favor of the domestic system: I might demonstrate the fallacy of the proposition that the prosperity of a large majority of the nation can ever be a partial prosperity, or operate to the real injury of the minority: I might show that, in no one instance, have the predictions of the friends of free

trade, in reference to the pretended evils which our system was to entail upon the nation, been verified; and, on the contrary, that all the good, and more, that was predicated of the system by its advocates, have been realized in the short epoch of its trial;—all this I might do, but I should feel it to be, at this day, and in the presence of this Institute, a supererogatory labor: the subject has been better handled by more competent advocates. I will, however, ask you to indulge me, before I conclude this address, with the privilege of briefly presenting the restrictive system to your minds in its connexion with a very important interest belonging to the national concern.

No department of the action of the government is more profoundly interesting to the welfare of the people, than that which relates to the preservation of a sound currency. The maintenance of the public confidence in the stability of the currency depends upon the adherence to the principle of payment in the precious metals: this principle alone can retain values at a permanently equal standard, or, at least, at a standard so nearly equal as to be subject to no other changes than those which occur in the precious metals themselves. Our circulation of bank paper is professedly founded upon this basis; and the amount of this paper thrown into current use is nicely adjusted by a rule, founded upon experience, which restrains the issue within the limits of a fixed proportion between the paper and the amount of specie in the country. This proportion may perhaps allow, in a period of prosperous trade, the emission of paper to five or six times the amount of specie applicable to its redemption. By such a rule, twenty millions of the precious metals would justify an aggregate emission of one hundred, or one hundred and twenty millions of paper. If, therefore, the demands of trade and domestic exchanges require a circulation of paper to the amount of one hundred millions, and the safe proportion of emission should be five of paper for one of gold or silver, it is obvious that the nation will stand in need of a specie deposite to the amount of twenty millions. All over this amount will be a surplus, useless to the currency, and applicable to the purposes of exportation or manufacture. It is obvious, if this proposition be true, that the subtraction of every dollar from the twenty millions, must be followed by a withdrawal of five dollars from the paper circulation, or else that the proportion between paper and specie must be increased beyond the limits of what is deemed a safe relation.

The past experience of the United States has shown that, by the operation of excessive production of manufactures in Europe, especially in England, resulting from the existence of a great mass of pauper labor in these nations, we are singularly exposed to the evils of importation much beyond the value of our exports. The practice of sending in upon us large amounts of merchandise upon foreign account, and the aid which this species of trade derives from our auction system, rendering the first enjoyment of our market a matter of eager and destructive competition between our own merchant and the foreigner, have greatly contributed to increase this liability to an over supply. The inevitable consequence of this state of things is a withdrawal of our specie to pay the difference in value between the export and the import; in other words,—a continuing unfavorable balance of trade steadily abstracts the precious metals from our coffers. By the balance of trade I do not mean the balance apparent in figures in the treasury reports;—I am aware that that is a false guide to the fact;—I mean that real, unreported balance, which is grounded upon the actual cost of our imports in the places where they are bought, and upon the actual value of our exports in the places to which they are carried,—of which it may be said, that the difference between them is rather felt in the state of exchange, than seen in any form of official exhibition. Until this difference is paid by a new supply of exports, which shall, in their turn, exceed the imports, the equilibrium cannot be restored, and there will be no return of the precious metals to supply the vacuum created by this course of trade,—and, consequently, until that period, no restoration of the paper circulation to its former condition. The inevitable effect of this state of things will be to occasion great and destructive changes in the money values of all the commodities of commerce. With what melancholy consequences such changes visit the world of debtor and creditor, it need not be told to an intelligent mercantile community like this, to whom, in part, I now address myself. I refer to the fact, in this brief form of comment, merely to indicate what I think a paramount principle of policy in regulating the concerns of our domestic industry, namely, that it should be a fundamental purpose, in the administration of the affairs of our government, to adopt such a system of duties as shall invariably confine the value of our imports

to a sum within the capacity of our exports to pay; and that this is the only sure method of preserving the currency in a sound and trustworthy condition, compatible with its expansion to the amount required in the operations of commerce. By a necessary law of political economy, that system of duties would never fail to afford all the encouragement and protection to our domestic labor which its friends could desire.

I have foreborne, gentlemen, to expatiate upon the principles and facts involved in this problem, because it would lead me into a larger discourse than the present occasion would justify; and I have, already, too much reason to be thankful for the patience with which you have borne the tax I have put upon your attention, to vex it with a further burden. The topics with which I have engaged your minds have necessarily led me into inquiries better suited to the retired study of the closet than to a popular forum; and, in the labor to adapt them to the brief hour I have allowed myself, I am sensible I have run the risk of rendering them obscure. I could not, however, look around me, from the position I at present occupy, without finding persuasions to solicit me into the range of discourse which I have pursued. Both within the walls of your exhibition room, and beyond its doors, these topics have been too prominently cast upon my notice to render it proper in me to avoid them. There, within, as in a casket, are the jewels of our policy—the bright and beautiful evidences of the value of our system; without, are the din and murmur of a great city, where every thing is instinct with life. The crowds that hurry through her avenues; the tumult of incessant transportation; the thronged harbor and the busy wharf, tell us that we sit at the great gate of the nation. Through these portals are conducted the exchanges of foreign and domestic trade; and their mutual reliance is here signally made manifest. It would not be wonderful, if you, gentlemen, accustomed as you are to look daily on this spectacle, and to inhabit in the midst of it, should forget, in the stupendous display of commerce around you, that there is a still greater, and infinitely more valuable field of enterprise in the interior country. The existence of this Institute shows that you have not forgot it; and the liberal zeal with which you pursue the great purpose of your association, declares that here, no less than in the bosom of the land, the true interests of America are clearly seen and ardently sustained. May the same intelligent and patriotic spirit take possession of every avenue of our republic, and dwell at every threshold: may it equally pervade the north and the south, the east and the west, the present and all future times!

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